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THE RELATIONS OF MIND AND MATTER.

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I. THE THREEFOLD NATURE OF EVOLUTION.

AT what level in nature does consciousness first come definitely into existence? This is one of the most difficult of the problems of science, and one which, perhaps, can never be clearly answered. At the limiting boundary of conscious and unconscious action it is quite impossible to tell, by any means at present at our command, whether blind force or intelligent agency is at work. Even within our own bodies it is difficult to limit the kingdoms of consciousness and unconsciousness, and equally difficult to decide that actions which seem now wholly unconscious were originally so. This question cannot always be decided by the claim that here reason has evidently been at work, and there only natural selection. For the results of reason and natural selection, as applied to the modification of the body and of its habits, are singularly alike. In each case adaptation to external conditions is produced, and there can be only certain definite adaptations to each limited set of conditions. Thus if the results of two energies are of precisely the same character, it is impossible to decide from these results which energy has been active. Where the change has been too rapid for the powers of natural selection, we may be sure that consciousness has been at work. But in the case of very deliberate changes we cannot positively decide to which force they are due, and some degree of conscious action may extend to a much lower level in the realm of nature than we usually imagine. On the other hand natural selection may be the sole active agency up to a somewhat high level.

Evolution has its three distinct and dissimilar phases, on each

of which natural selection acts, though it is customary to apply this principle to only the second of these phases. These are the chemical, the functional and the psychical. So far as organic evolution is now concerned, chemical development has become of minor importance. Yet originally it was of supreme importance. In fact, the whole vast range of inorganic chemical development was a necessary preliminary to organic existence, and constituted the primary phase in that grand whole of evolution which is a continuous and not a broken chain.

Very probably, in the primeval period, inorganic chemism yielded far more complex compounds than any it now presents. The conditions of temperature at that period, and the fluid state of many elements which are now found only as rigid solids, must have aided such a chemical activity. Even now more complex compounds than we find would doubtless exist but for a reason to be considered further on. This primeval chemical evolution may have gone on for ages without impediment, yielding steadily higher and more complex products, every fixed stage of which formed the basis for a new upward step of material development, until finally a stage approximating to that of protoplasm was reached. But long before this stage was attained, it is highly probable that functional evolution came into play, and at once acted as a check to the rapid progress of chemical development. As soon as an unstable colloid compound was thus produced, so constituted as to be subject to the disintegrating attacks of oxygen, self-motion of such matter may have begun, and the long reign of functional activity originated. This is all we find in functional life now, the self-motion of unstable colloids through the action of the energy set free by oxidation, and it is quite probable that such activity began as soon as a primeval colloid, of suitable constitution, was produced.

But chemical evolution could not have ceased with this first appearance of functional action. It must have long continued, yielding products of higher and higher complexity, and more susceptible to the function-producing influences, until finally the excessively mobile compound now called protoplasm originated. Yet there can be no doubt that with the earliest appearance of functional activity a check was placed upon chemical development. This check grew more vigorous as functional action became more unfolded. Finally a practical limit to the increase of chemical

integration was reached, and functional activity took its place, as the second great agent in evolution. Yet this check to chemism could have been by no means completed with the first appearance of active living forms. Superior and more susceptible proteids may have continued to appear, perhaps to the very borders of the present time, rendering the operation of functional change more and more active and capable. There is certainly good reason to believe that the protoplasmic basis of all beings is not identical, and if so, that chemical evolution may have continued, with ever-decreasing efficiency, throughout the whole long period of organic existence. As for the utter disappearance of the link forms between protoplasm and the highest existing inorganic compounds, it is no more surprising than the similar disappearance of so many of the link forms of life. They have been crowded out of existence by natural selection. Protoplasm doubtless has its embryology, whose steps, if we could trace them all, would lead us to a knowledge of its phylogeny. Many of the high-atomed products which successively appear in the development or during the disintegration and decay of organisms may be identical with primeval compounds which preceded protoplasm. Yet all of these have their enemies in the vast and varied hosts of fungi which depend upon them for nutriment. They no sooner cease to be protected by the energies of active life, than they are assailed and partly reduced to simple inorganic conditions, partly become food for fungi.

We can readily conceive, then, that were high-atomed chemical compounds now formed from the elements, by inorganic agency, they would in all probability be at once attacked by fungi, and consumed as nutriment or disintegrated. The incessant activity of the fungoid organisms places a definite check on any high inorganic evolution under present conditions. Yet, as above said, in the existing formation of protoplasm, its phylogeny is indicated precisely as the ancestral forms of the higher animals are indicated in their embryological development. Many of the steps may be slurred over in the one case as in the other, and in the formation of protoplasm by the plant, through successive integrations, from carbonic acid, water and ammonia, we may have a greatly shortened and masked preservation of the original steps of the development of protoplasm from the inorganic elements. The time may come when the human form can be phylogeneti-

cally traced, not only to the rhizopod, but to the chemical elements.

The second great phase of material evolution, the functional, which has gradually unfolded until, from forms lower than the rhizopods—mere homogeneous masses of protoplasmic molecules—it has produced the extraordinarily intricate and heterogeneous form of man, as the highest existing stage of material combination, is due to the operation of two characteristics inherent in protoplasm. The first of these is the power of self-movement, through the agency of internal energy set free by oxidation. The second is the power of inducing new chemical action to the production of new protoplasm. The mode of operation of this second agency is as yet in great part a mystery. But that it exists is too evident to be for a moment questioned. And there is considerable reason to believe that these two agencies do not act simultaneously, but that oxidation of protoplasm and reintegration of the same are always successive processes in the organic economy.[1]

At some period in this long process of organic development there came into operation a third distinct phase or process of evolution, the psychical or mental phase. It is this with which we are here alone concerned. Its appearance and unfoldment seem related to functional action as the latter is to chemism. Psychical action has constantly tended to check functional variation, and to replace it by a new controlling agency. As organic action slowly checked the development of chemism, and at last wholly or nearly superseded it, so psychical action has opposed the energy of functional variation and, in the case of man, has largely superseded it. The three modes of energy here indicated are probably all due to the action of forces inherent in the constitution of matter, and some of the conditions of this action are very evident. These it may not be amiss to briefly indicate.

Every mass of matter, however composed, is constantly affected by two sets of forces, those acting internally and tending to preserve and increase its complexity of organization, and those acting upon it from the external world and tending to reduce or destroy its complexity. In chemical integration the internal energy is in the ascendant. The compound is formed by the innate forces of its elements, and grows more complex through

[1] See The Organic Function of Oxygen, AMER. NAT., Feb. and March, 1883.

the continued activity and supremacy of these forces. Yet all such compounds are constantly subject to the action of external forces, and are occasionally disintegrated or otherwise affected thereby. The more complex the compound the more exposed is it to the disturbing influence of external energy. At the same time the more complex the chemical compound, the less vigorous is the action of the innate energies of affinity. It is evident, therefore, that at some point a balance between these opposed energies must be reached. While chemical energies continue superior there must be a gradual increase in the complexity of compounds, despite the assaults of external energy. But when these opposing energies become definitely equal in vigor, it seems evident that a fixed status must result. There may be upward and downward swings, as one or the other agency gains a temporary supremacy, but the general level cannot permanently be departed from.

Such is apparently the chemical status of protoplasm. It indicates the level of balance between internal and external energies. If it be broken down by a vigorous influx of external energy, the activity of chemical energy becomes superior, and reintegration sets in until the balance of forces is again attained. Chemism cannot go further and produce a stable compound of higher complexity. Yet there is good reason to believe that unstable compounds of this high character are frequently produced, molecules lifted above the general level, and therefore liable to break down instantly at the least influx of external energy. It is probably to the existence of such excessively complex molecules that the high sensitiveness of nervous and muscular tissue is due. Lifted too far above the level of harmony of the forces, they break down at a touch.

Other results follow. Motor forces are set free within the tissue which give it self-motion. This self-motion brings it into new relations with external substances, and other changes than purely chemical ones follow. Variations in form and constitution in response to these external influences take place. Natural selection upon function and form comes into play, and the organism that resists the adapting influence of external energy ceases to exist. Only those mobile organisms that readily yield to the molding influence of external energy, and closely adapt themselves to the conditions of nature continue to exist. Thus in the

chemical phase of evolution internal energy is in the ascendant and controls the results. In the functional phase chemical energy merely holds its own, and a fixed molecular status is gained. But external energy acts upon tissue as a whole, and produces definite variations in form.

If we now come to consider psychical evolution we find it still to be a question of the interplay of internal and external energies. Reference here is made to its purely physical results, and not to its important characteristic of consciousness. In the growth of psychical conditions we still have to do with the external energies which play upon the body and force their way into it over the channels of the nerves. But as the body improves in its sensory organization, and permits the ready inflow of external energy, the balance between the two series of energies is broken, external energy becomes in excess and there is a tendency to break down the molecular complexity of the body to a lower level. Could all those inflowing energies play upon the muscles a fixed fall in the chemical level must succeed. As it is, however, these energies are checked in their inflow. The muscles are permitted to receive no more than they are prepared to accept. The remainder are restrained in their action to the cerebral ganglion, where they exert an organizing influence upon some substance whose character is as yet a problem. This is the third or psychical phase of organic evolution.

The motor energies, thus drafted off into this cerebral substance, there combine into a congeries of forces of yet unknown character, which we call the mind. It has two characteristics. The energies which constitute it are persistent. And they enter into new combinations which have no counterpart in external nature. It constitutes a new center of force which in its turn acts upon the body and aids in molding it. External forces are no longer supreme. A reservoir of internal energy has been formed which frequently acts in opposition to them. And one of the most essential characteristics of the action of this mental center of force is, that its activity is not exhausted upon the body. In fact it finds an important field of action in the external world. It molds nature as well as the body. In place of the organism needing to adapt itself to external conditions, it acts to adapt external conditions to itself, and its own need of change is obviated to the extent that it acts upon and remodels the world without.

All the numerous products made by man, his clothing, habitation, tools, &c., and all the changes in the conditions of nature produced by his agency, are results of this third phase of evolution. Functional change is forced upon the external world, and to that extent ceases to act upon the body. Harmonious adaptation continues necessary, but nature is made to adapt itself to man, and man has little need to adapt himself to nature. It is not, however, a simple reaction, through the body, of external forces upon external nature. A reaction of this kind exists throughout organic life. Every motion of an organism in direct response to the impulse of external influence exerts an influence upon external nature. But as a rule it produces no new conditions. Adaptation is mainly confined to the body. In psychical action, however, new conditions are produced. The energies which have flowed into the cerebral reservoir are there recombined into new aggregates, or ideas, as we name them. These, in their reaction upon external nature, produce new conditions, embodiments in matter of new relations of energy, and the substances external to the body are forced to adapt themselves to the needs of the organism.

This psychical reaction upon external nature is not a common characteristic of animal action. It is specially active in man, and presents a considerable activity in some of the lower tribes, as the beavers, the ants and the bees. But in the great majority of animals it is almost non-existent. Very few even of the higher vertebrates make any effort to adapt nature to their needs, but accept existing conditions. In such cases all the molding action of energies must be exerted upon their bodies, and such adaptation as becomes necessary must be confined to the organism.

Yet psychical action in these lower animals is not without its special results, distinct from those yielded by the direct action of external energies. It yields rapid variations in the habits of the animal, adapted to particular cases, and which often enable it to survive where otherwise it would perish. These may be special movements in flight or combat, new modes of concealment, the display of cunning in non-habitual manners, and the like. In fact, in the difficulty of deciding whether any animal is influenced by mental energies or not, we are in great measure dependent on the occurrence of unusual actions, adapted to special situations. If actions are habitual they may be unattended by con-

sciousness, even though they seem to display the utmost accuracy of reasoning. Natural selection yields results so closely analogous to those of reason that it is almost impossible to discriminate between them, and in fact quite impossible except where a change of habits is displayed too great and sudden to be possibly due to the action of unconscious agencies on the slight congenital variations in animal forms.

In attempting to decide, then, at what level of life consciousness comes into definite existence, we are met with this difficulty. Actions of the most intricate character, such as many of those performed by the ants, for instance, are not beyond the conceivable powers of natural selection if they have been for very many generations practiced, with extremely slow variations, by one species. Yet ants adapt nature to their needs, and thus counteract the action of physical conditions upon their bodies. Therefore that phase of activity which we have above considered specially significant of psychical agency—the remodeling of external conditions—seems to be not beyond the scope of natural selection, and only where the adaptation is individual instead of tribal, and rapid instead of gradual, can we be sure of its psychical origin.

If, for example, we consider the great kingdom of vegetable life, there are abundant reasons to believe that, in all of its higher manifestations, at least, it is devoid of consciousness. And yet its adaptations to the conditions of nature are often so complex and extraordinary that it seems almost incredible that they could have arisen without the aid of reason. Only the unpitying energy with which nature weeds out all illogical adaptations can explain the logical consistency of those that persist. If the habits of an animal change in response to logical reasoning, this change must be in the direction of exact adaptation to nature. But the same end is achieved by the blind but vigorous agency of selection, which is utterly merciless to the ill-adapted. If we could imagine plants to be suddenly given the power of motion, and thus brought into new and more varied relations to nature, it is evident that their adaptations might become yet more intricate, and still more like the results of intelligence and judgment, though gained through the action of unconscious influences. In such a case they might readily rival many of the lower animals, and unconsciously perform actions closely analogous to those which it

is usual to ascribe to consciousness. In fact, the plant world is not utterly destitute of such motor powers. The mycelium of the Myxomycetes so closely simulates the Amœbæ in its motions that it is difficult or impossible to distinguish it from the latter. Yet it is but a plant in motion, and is undoubtedly unconscious. Again the white blood corpuscles of animals are also indistinguishable from Amœbæ in character and habits; yet we can scarcely credit each of them with conscious life. At a higher level in plant life we again meet with motor powers. Thus the carnivorous plants display characteristics not unlike those seen in the polyps; yet they are unquestionably unconscious, and we might safely ascribe a similar unconsciousness to the polyps and all other animals of similarly low grade.

Thus if we begin at the lower levels of organic life, and trace nature upward in her development, it is very difficult to perceive where the influence of heredity and natural selection ceases to act and conscious choice enters into life as an element. On the other hand if we commence with the conscious life of man, and trace nature downwards, it is equally difficult to decide where consciousness ends. For at a certain intermediate level the phenomena observed might safely be ascribed to either conscious or unconscious action. Both seem capable of producing them, and it is utterly impossible to decide, with our present knowledge of the subject, which does produce them. Where there is evidence of unusual choice in some animal, or marked variation from its hereditary habits, we can be sure of conscious activity. On the other hand, where there is no nervous system, and no cerebral organ or force reservoir, we may reasonably question the existence of psychical powers. And yet, even in this extreme case, we cannot positively declare that consciousness does not exist. In fact, although we may imagine that we are considering two conditions of whose actual existence we have equal knowledge, such is really not the case. Man finds in himself his only standard of comparison. We know that within ourselves consciousness exists, and oversees, though it may not directly control, the great mass of our actions. We know, on the other hand, that many of our actions are performed unconsciously. In considering the activities of lower nature, then, we cannot actually know that consciousness may not, to some extent, accompany them. We have some warrant to say that the unconscious action, which

is exceptional with us, is the rule with them, but we can at no level positively declare, "here it is absolutely impossible that consciousness should exist." We must understand the subject far more thoroughly than now ere this question can be definitely decided.[1]

(To be continued.)

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KITCHEN GARDEN ESCULENTS OF AMERICAN ORIGIN. II.

BY E. LEWIS STURTEVANT, M.D.

(Continued from p. 457, May number.)

Jerusalem Artichoke.—Botanical analogies and the testimony of contemporaries agree, as we have seen, says De Candolle[2] in considering this plant to be a native of the north-east of America. It was introduced to England about 1617, as we learn from the second edition of Gerarde,[3] and this is nearly coincident with the first mention of this species in Europe, that by Fabio Colonna.[4] Lescarbot brought these roots into France about this time.[5] "Hartichokes" are mentioned as growing in Virginia in 1648,[6] and "artichokes" were cultivated at Mobile in 1775, but whether this plant or not, does not appear from the context.[7] They are mentioned by writers on American gardening from 1806 onward.[8] In Pennsylvania the tubers are yet raised by some and sent to the New York market, "they are disposed of for lunch purposes and there is a ready sale."[9]

Most interesting articles on the geographical and botanical history of this plant, by Messrs. J. Hammond Trumbull and Asa Gray, will be found in the *American Journal of Science,* May, 1877, and April, 1883.

Martynia.—Two species, *Martynia proboscidea* Glox. and *M. lutea* Lindl., occur in our gardens, the seed pods while yet tender

[1] See in this connection Cope, On Catagenesis, AMER. NAT., Oct., 1884.

[2] Orig. of Cult., Pl. 44.

[3] Herbal, 1636, 753.

[4] Ecphasis minus cognitarum stirpium, Rome, 1616.

[5] Hist. la Nouv. France, 1618.

[6] A Perfect Disc. of Va., Lond., 1649, 4.

[7] Romans, Nat. Hist. of Fla., 1, 115.

[8] M'Mahon, 1806, Gardiner and Hepburn, 1818, as good for hogs and cattle, Fessenden, 1828, etc.

[9] Agr. of Pa., 1883, 358.

serving for pickles. The former was first known in Europe in 1738, the latter, a South American species, not until 1824.[1] *M. craniolaria* Glox., the white flowered, has appeared by name in one at least of our seed catalogues among garden vegetables. It was described in 1785. *M. violacea* Engelm. occurs in the Southwestern States, and the Apache Indians gather the half ripe seed pods to be used for food.[2]

The Martynia was not an inmate of our kitchen gardens in 1828, not being mentioned in Thorburn's seed catalogue of that date, nor in Noisette's Manual du Jardinier. It is not mentioned for American gardens by Schenck in 1854,[3] but is by Burr in 1863.[4] It hence may be considered as of recent introduction.

Nasturtium.—Tropæolum majus L. and *T. minus* L., find place in our seed catalogues for use as a garnish and salad, and the unripe seed pods for salads and pickling.' Both are natives of Peru. The former came to Europe in 1684, according to Linnæus,[5] or 1686, according to Noisette,[6] and according to Collinson's manuscripts it reached England in 1686. The dwarf nasturtium was known at Lima in 1580 by Dodonæus, was cultivated in England by Gerarde in 1596, and was a great favorite with Parkinson in 1629; it was then lost, but afterwards reintroduced. Miller, in 1768, says it was then only less common than the tall.

Both the tall and the dwarf were in French kitchen gardens in 1828,[8] but the tall seems to have then only reached our culture, as the dwarf is not mentioned in Thorburn's seed catalogue of 1828. The tall is mentioned by M'Mahon as in American gardens in 1806, by Gardiner and Hepburn in 1818, and the tall and dwarf by Bridgeman in 1832. Both were grown in English gardens in 1778.[9] One common name, "Indian cress," used as late as 1854 by writers on American gardening, would suggest that the use as a vegetable was coincident with its second introduction, as Parkinson's fondness for it would seem to imply.

[1] Noisette Man. du Jard., 537.
[2] Dept. Agr. Rept., 1870, 422.
[3] Gard. Text-book.
[4] Field and Gard. Veg. of Am.
[5] Miller's Dict.
[6] Man. du Jard., 508.
[7] Miller's Dict.
[8] Noisette, Man. du Jard., 337.
[9] Mawe's Gardener.

The nasturtiums have received greater welcome in our flower gardens than for table use, and a large number of varieties have been developed as florists' plants.

Peppers.—There seems to be now scarcely a doubt as to the American origin of the peppers, *Capsicum sp.* It seems, however, to have escaped the attention that it deserves, that the large number of forms already developed at the time of the discovery of America is indicative of a long cultivation, and adds testimony to the agricultural habits of the people. A vernacular name, especially if short, is very persistent in its horticultural use, and in those varieties of vegetables which are grown in kitchen gardens, some names alone, without descriptive text, may be assumed as indicative of the existence of a variety to which the same name is applied to-day. Such investigations as we have made indicate that this is especially true for the peppers.

How many species there are of peppers I cannot make out. Many described species can be unhesitatingly referred to *Capsicum annuum*, a species of great variability, and which seems to be a perennial in some regions, as in Florida, as I am informed, and in Chili, according to Molina. We shall make use of the specific names as we find them.

According to Bancroft[1] the use of peppers by the Southern natives was as great in ancient times as is now observed. Sahagrun[2] mentions chili more frequently than any other herb among the edible dishes of the Aztecs; Veytia[3] says the Olmecs raised chili before the time of the Toltecs. "It is the principal sauce and the only spice of the Indians" as Acosta writes in 1578, and Schomburgh says that the present Indians of Guiana eat the fruit of these plants in such abundance as would not be credited by an European unless he were to see it. Columbus carried peppers with him on his return voyage in 1493,[4] and Peter Martyr, in his epistle dated September, 1493, says it was "more pungent than that from Caucasus."[5] In 1494 a letter written by Chanca, physician to the fleet of Columbus on his second voyage, to the Chapter of Seville, refers to its use as a condiment. Capsicum and its uses are more particularly described by Oviedo,

[1] Native Races, II.

[2] Hist. Gen., II, lib. VIII.

[3] Hist. Ant. Mej., I, 154.

[4] Irving's Columbus, I, 238.

[5] ib., III, 425.

who reached tropical America from Spain in 1514. Clusius asserts the plant was brought from Pernambuco by the Portuguese to India, and he saw it cultivated in Moravia, in 1585.[1]

Hans Stade,[2] during his captivity in Eastern Brazil, about 1550, says the "pepper of the country is of two kinds; the one yellow the other red; both, however, grow in like manner. When green it is as large as the haws that grow on hawthorns. It is a small shrub about half a fathom high, and has several leaves: it is full of peppers which burn the mouth." G. de Vega,[3] writing of Peru in 1609, says the most common pepper is "thick, somewhat long, and without a point. This is called '*rocot uchu*' or 'thick pepper,' to distinguish it from the next kind. They eat it green, and before it assumes its ripe color, which is red. There are others yellow, and others brown, though in Spain only the red kind has been seen. There is another kind, the length of a *geme* (5 inches ?), a little more or less, and the thickness of the little finger. These were considered a nobler kind, and were reserved for the use of the royal family. * * * * Another kind of pepper is small and round, exactly like a cherry with its stalk. They call it '*chinchi uchu*,' and it burns far more than the others. It is grown in small quantities, and for that reason is the more highly esteemed." Cieza de Leon,[4] who traveled in Peru, 1532–50, speaks of the Capsicum as a favorite condiment of the Peruvian Indians. Molina[5] says many species of Capsicum called by the Indians "*thapi*" are cultivated in Chili, among others the annual, which is there perennial, the berry pimento and the pimento with a subligneous stalk. Wafer, 1699,[6] says on the isthmus they have two sorts of pepper, the one called *bell* pepper, the other *bird* pepper, and great quantities of each are much used by the Indians." Each sort grows on a weed or shrubby bush about a yard high. The *bird* pepper has the smaller leaf, and it is by the Indians better esteemed than the other." Ligon, 1647–53,[7] also mentions two sorts in Barbadoes, "the one so like a child's corall as not to be

[1] Pharmacog., 406.
[2] Hak. Soc. ed., p. 166.
[3] Royal Com. Hak. Soc. ed., II, 365.
[4] Hak. Soc. ed. Travels, 232, note.
[5] Hist. of Chile, ed. of 1808, I, 95.
[6] Voy. to Isth. of Am., 100.
[7] Hist. of Barbadoes, 79.

discerned at the distance of two paces; a crimson and scarlet mixt, the fruit about three inches long, and shines more than the best polished corall. The other, of the same color and glistening as much, but shapt like a large button of a cloak; both of one and the same quality; both so violently strong, as when we break but the skin, it sends out such a vapor into our lungs, as we fall all a coughing. * * * * It grows on a little shrub, no bigger than a gooseberry bush." In Jamaica, Long[1] says "there are about fifteen varieties of the Capsicum in this island, which are found in most parts of it. Those which are most commonly noticed are the *bell* pepper, *goat, bonnet, bird, olive, hen, barbary, finger, cherry,* &c. Of these the *bell* is esteemed most proper for pickling."

Capsicum annuum L., has never been found wild, but *C. frutescens* Willd. has been found wild, apparently indigenous, in South America. De Martius brought it from the banks of the Amazon, Poeppig from the province of Maynas in Peru, and Blanchet from the province of Bahia.[2] The form, *C. indicum* Rumph. = *C. frutescens* L., is said by Ainslie[3] to be constantly found in a wild state in the islands of the Eastern archipelago.

Capsicum annuum L.—According to Naudin *C. longum* DC., and *C. grossum* Willd., are not specifically distinct from this plant. It is said by Clusius to have been brought by the Portuguese from Brazil to India,[4] and reached England in 1548;[5] and is mentioned by Gerarde as being under cultivation in his time. The fruit is variable in form and color, as is also the plant. It was mentioned by Louriero (1790 or 1798) as a cultivated plant of Southern China, but has not been noticed by the Chinese writers of the sixteenth century or in others of more recent date, although nowadays much cultivated in China.[6] It is the *chilli* pepper of India, according to Firminger,[7] while Drury assigns the name *chilly* to *C. frutescens* L.

C. angulosum Mill. (1743).—Bonnet pepper of Miller. It is a variety of the preceding, and was described by Tournefort in

[1] Jamaica, ed. 1774, book III, chap. VIII, 721.
[2] De Candolle, Orig. of Cult. Pl., 290.
[3] Mat. Med., I, 306.
[4] Pharmacog., 453.
[5] Booth, Treas. of Bot.
[6] Bretschneider, On the study, &c., p. 17.
[7] Gard. in India, 153.

1700.[1] The name is the same as used by Long for one of his Jamaica varieties, and is perhaps one of the sorts described by Ligon, 1647–53, as occurring in Barbadoes, "shaped like a large button of a coat." The fruit is described by Miller as variable, some being bell-shaped, and Tournefort's name would imply a heart-shaped fruit.

C. baccatum L.—Bird pepper, according to Miller, and synonymous with *C. frutescens* var. L., *C. fructu minimo conico rubro* Brown, etc., and described among Jamaica plants by Sloane and Brown, in Amboina by Rumphius (1750), and as *C. brazilianum* Clusius (1601). It differs little from *C. frutescens*, and the berries are very pungent. *Bird* pepper is mentioned by name by Long in Jamaica, and by Wafer for the Isthmus; is perhaps the pepper "as large as haws" described in Brazil by Hans Stade. It has been in England since 1731,[2] and a "*bird* or *West Indian*" was in American gardens preceding 1828. It is mentioned as well known in India by Firminger and Drury, but I do not identify it with any of the present varieties of our seed catalogues. From an uncertain authority[3] it is said to grow wild from Southern Texas to Arizona, but it is not catalogued in the report on the plants of the "United States and Mexican Boundary Survey," 1858, unless it be synonymous with *C. microphyllum* Dun.

C. cerasiforme Mill.—Cherry pepper, also described by Tournefort, 1700. It was sent from the West Indies. It is probably one of the sorts described for Peru by Garcilasso de la Vega under the name *chinchi uchu*. It is also among the names listed by Long for Jamaica, and was in American gardens in 1806 or before. It is a variety of *C. annuum*, and the fruit is quite variable in form and color, some sorts being yellow. The form figured in Hortus Eystellensis, 1613, is precisely the cherry pepper of our gardens.

C. conoides Mill.—Came to Miller from Antigua under the name of *hen* pepper. This is a name which appears in Long's list of Jamaica sorts. The description of the fruit would answer to that of the oxheart of some of our seed catalogues.

C. cordiforme Mill., or heart-shaped Guinea pepper, was also described by Tournefort, 1700.[4] It has several varieties, the

[1] Miller's Dict.
[2] Booth, Treas. of Bot.
[3] Vick's Monthly, 1879, 184.
[4] Miller's Dict.

fruits varying in size, shape and color, some sorts bearing yellow. It can be referred to *C. annuum*, and seems to be the oxheart of some of our seedsmen.

C. fastigiatum Blume, syn. *C. minimum* Roxb.—It is the *C. frutescens* L. Spec. Plant., but not of L. Hort. Clif., to which the name *C. frutescens* is usually applied.[1] It occurs abundantly wild in Southern India, and is extensively cultivated in tropical Africa and America.[2] According to Miller it is *C. indicum* Rumph. (Amboyna), and the *Capo-molago* of Reede (Malabar) which fixes its presence in the East Indies about 1700. It is described by Loureiro, and was in England in 1656. It does not appear to be among the species grown in American gardens, all of which can be referred to *C. annuum*.

C. frutescens L. — This has been called *barbary*, *cayenne*, *shrubby* and *goat* pepper. It seems to have occurred in our seed catalogues under the name of True Cayenne, but does not appear to be cultivated with us now. It was in English gardens in 1656,[3] and seems to have been called *barbary* from the size and shape of its fruit, which are like those of a berberry. It seems to be cultivated and to have native names in Hayti, Peru, Mexico, India, Burma, Malabar, Ceylon, Yemen, Greece, Egypt, &c., and furnishes much pod pepper to commerce. It has been found wild from Bahia to Eastern Peru in tropical America.[4] In Ceylon a red, a yellow and a black fruited form are known.[5]

C. grossum Willd.—This is the pepper with large sweet square fruits, and furnishes many varieties and synonyms to our seed catalogues, and is considered to be but a form of *C. annuum*. It may be the *rocot uchu* of G. de Vega. It was, according to Miller's Dictionary, described by Besleri in 1613,[6] by Bauhin in 1671, and by Tournefort in 1700. *C. tetragonum* is a synonym by Miller, 1737. It was cultivated by Miller in 1759. According to Noisette[7] it reached Europe in 1548. It is called in Hindustani *kaffrie-murich*, and the fruit, as large as a small apple, is called by the English in India *coffrie chili*,[8] or, according to Fir-

[1] Pharmacog., 452.
[2] ib.
[3] Booth, l. c.
[4] De Candolle.
[5] Moon, Cat. of Ceylon Pl., 16.
[6] The type, but not our varieties in Hortus Eystellensis, (Besleri), 1613.
[7] Man. du Jard., 520.
[8] Ainslie, Mat. Med., 1, 307.

minger, *bell* pepper.[1] The squash or tomato-shaped, sweet mountain, sweet Spanish and many other similar varieties of our seed catalogues belong to this form, of which the first was in our gardens preceding 1828, as also this and the sweet Spanish in French gardens. There are red and yellow sorts, as in most of the so-called species. This is perhaps the *bell* of Long's Jamaica list, as he says it is esteemed most proper for pickling.

C. longum DC. is another form usually referred to *C. annuum.* It reached Europe in 1548,[2] or before,[3] and would appear to be the second kind, so much esteemed, of De Vega, and the one of the sorts referred to by Ligon as "resembling a child's corall." *Corail* is yet one of the names for this sort in France. It was grown in England in 1597 and before, as Gerarde speaks of it. There is a figure of it in Fuchsius' Historia Stirpum, Basle, 1542, under the name of siliquastrum or calicut pepper, and a statement that the plant had been introduced into Germany from India a few years previously.[4] It was in American gardens, by name at least, before 1806, and is the *long red* or *long yellow* of our present seed catalogues.

C. microphyllum Dun. is said by Torrey to occur in Western Mexico, Chihuahua, Nuevo Leon, etc., but he does not say whether cultivated or wild. The Mexicans call it *chipatane*, and use the fruit like other red peppers.[5]

C. nepalense Drury is a variety growing in Nepaul, and very pungent and acrid.[6]

C. olivæforme Mill.—A variety of *C. annuum*, and described by Miller in 1752, and by Tournefort in 1700. It came from Barbadoes,[7] and the name appears in Long's Jamaica list. It may be the sort which appears in our catalogues under the name of cranberry, but other kinds occasionally produce olive-shaped fruits.

C. sinense L.—This sort was described by Linnæus and Jacquin about 1770–76, the fruit yellow. It is cultivated in Martinique.[8]

C. tetragonum.—This is said by Booth[9] to be the *bonnet* pepper

[1] Gard. in India, 153.
[2] Noisette, l. c.
[3] 1542, Fuchsius.
[4] Pharmacog., 453.
[5] Report of the Bot. of U. S. and Mex. Bound. Survey, 152.
[6] Drury, III.
[7] Miller's Dict.
[8] Miller's Dict.
[9] Treas. of Bot.

of Jamaica. The name appears in Long's list, edition of 1774. *C. tetragonum* Mill., 1737, is referred by him to *C. annuum* L., and also to *C. grossum* L., to which latter form it appears to rightly belong. It is now cultivated under the name of *paprika* in Lower Hungary on a large scale, the fruit three and a half to five inches long and three-quarters to one inch in diameter.[1] As this is a sweet variety, it is probably *C. grossum*, which is a form with very variable fruit. The name *bonnet* pepper is used by Miller, 1743, for *C. angulosum*, as already stated.

C. violaceum Humb. is apparently a variety of *C. annuum*, but the plant more or less deeply violet-tinted, the fruit black-violet on one side and reddish-green on the other, but becoming red in ripening. It came from Spanish America, and is now an occasional inmate of our gardens.

The twenty-two named varieties grown during 1882 and 1883 at the New York Agricultural Experiment Station seem to belong to *C. annuum* L., and while we are not prepared to affirm that they all can be identified with one or the other of the above named species, yet we think there is probable identification sufficient to justify the conclusion that no strongly marked sorts have appeared during the five centuries of European culture. When we consider that the various kinds of peppers easily cross-fertilize, and hence the difficulty of keeping the sorts distinct, we are led to believe that many of the forms which have received specific description are true agricultural or form-species, sufficiently distinct at their first appearance by discovery to justify a conclusion as to a long antiquity, and as to their power of resisting change. The whole *genus* needs revision from an agricultural instead of a strictly botanical standpoint.

Potato.—De Candolle in his Origin of Cultivated Plants, says truly: "No one can doubt that the potato is of American origin." There are some interesting notes, however, which De Candolle has not used. Prescott in his Conquest of Peru,[2] says in 1526 Pizarro, at the Rio de San Juan, eat the potato as it grew without cultivation. This evidence is as conclusive as to its wild state as the one which De Candolle quotes from Gray, which "sufficiently proves its wild state in Chili, viz., that even among the Araucanians, in the mountains of Malvarco, the soldiers of

[1] Gard. Chron., Sept. 10, 1881, 343.
[2] I, 248.

Pincheira used to go and seek it for food.[1] Prescott adds, on the authority of Xerez,[2] that along the coast of Peru he saw the hill-sides covered with the potato in cultivation.

Pedro de Cieza de Leon, who traveled in Peru, 1532–5, says that the principal food of the Collao was potatoes, which "are like earth nuts."[3] John Hawkins, in his second voyage, 1564, says the potatoes at Margarita island, "be the most delicate rootes that may be eaten, and doe far exceede their parsenips or carets,"[4] which, if sweet potatoes be not meant, indicate their introduction to the island, as the context parsenips and carets shows. Captains Preston and Sommers, 1595, say at Dominica island "the Indians came unto us in canoes * * * * and brought in them plantains, pinos and potatoes,"[5] which indicates how potatoes and other victuals were taken aboard ships as provisions. Under the name *openawk* Heriot describes, in 1584, what is supposed to be the potato in Virginia, and of which De Candolle thinks there can be no doubt. This fact would seem to indicate that *potatoes* in our quotation meant potato and not the sweet potato. It is quite probable that Hawkins carried the first potatoes to Virginia, for in 1565, after relieving the famine among the French on the banks of the River May (St. Johns), he sailed northward toward Virginia, which name included the Carolinas and a large extent of coast at this time, and had this tuber aboard as he brought tubers from Santa Fé de Bogota on this voyage into Ireland, as has been currently stated, and we know not upon what evidence Miller and Sir J. Banks believes these tubers to have been the sweet potato. What renders the opposite view more tenable is the course that ships customarily sailed, this being to Virginia by the way of the West Indies; and as well by the fact that Virginia received the potato from the beginning of its settlement. It is mentioned by Heriot, 1584, as already stated; is noticed there again in 1609,[6] in 1648,[7] and again in 1649 under circumstances that can leave no doubt: "The West India potatoe (by much more delicate and large than we have here grow-

[1] Flora Chiliena, v, 74.
[2] Conq. del Peru ap. Barcia, III, 181.
[3] Travels. Hak. Soc. ed., 360.
[4] Sec. Voy. Hak. Soc. ed., 27.
[5] Hak. Voy., IV, 62.
[6] A True Decl. of Va., Lond., 1610, 13.
[7] A perfect Desc. of Va., 1649, 4.

ing) besides that it is a food excellently delicious and strongly nourishing, fixes himself wherever planted, with such an irradicable fertility, that being set it eternally grows."[1] We see here the distinction drawn clearly between the sweet potato described and the potato already under cultivation.

The argument that if the introduction by Hawkins into Ireland had been the potato, it would have secured dissemination, loses its force when we consider the slowness of its progress in England. It was certainly grown by Gerarde in 1597. In 1663 Mr, Buckland, of Somersetshire, drew the attention of the Royal Society to its value, earnestly recommending the general cultivation of the potato throughout the kingdom. In 1664 Forster recommends its cultivation in England. Ray, 1686, takes no further notice of the potato except by saying it is dressed in the same manner as Spanish batatas; Merritt, 1687, records that potatoes were then grown in many fields in Wales; Worlidge, 1687, describes potatoes as being very useful as "forcing fruits," and does not hear that field culture has yet been tried; Lisle, a little later, is wholly silent about the potato, as are also London and Wise, 1719; Mortimer, 1708, says the potato is not as good nor as wholesome as the Jerusalem artichoke, but that it may prove good for swine; Bradley, about 1719, says they are of less note than horse-radish, radish scorzoners, beets and skirrets, but as they are not without their admirers, he will not pass them by in silence. Other authorities to the same purport are given in Martyns Miller's Dictionary.

This reference to quality by Mortimer[2] is suggestive that the potato, until improved by European culture, was not the vegetable it now is for quality, and this poor quality it then may have possessed, may account for its slow progress, and even for its former recommendations for animals rather than for man, as by Worlidge above quoted, and Clusius says that the plant had become so common in Italy that it was eaten like a turnip and given to the pigs. Targioni does not, however, recognize this former wide cultivation in Italy, and says that it was only at the end of the sixteenth century or beginning of the seventeenth that the cultivation became known in Tuscany. In support of the theory that the potato was not as palatable in early times as now,

[1] Virginia by E. W[illiams], Gent., Lond., 1650, 48.
[2] Gard. Kalendar, 1708.

we may quote a few authorities. Miller, in 1754, says they were despised by the rich and deemed only the proper food for the meaner sort of persons. Mawe and Abercrombie, 1778, give caution as to their deleterious properties unless thoroughly well cooked. In 1830, in Watson's Annals of Philadelphia, it is written that a gentleman, "now in his 90th year, told me that the potatoes used in his early life were very inferior to the present. They were called Spanish potatoes, and were very sharp and pungent in the throat and smell. They send occasionally a better sort from Liverpool." In 1698 potatoes were scarce, Jerusalem artichokes abundant, in French markets.

Were a new root equal in edible quality to our snowflake potato and of the same ease of culture, now introduced, who can doubt its quick recognition and adoption? It would not be compared to the parsnip or carrot, as Hawkins did his potato, but would be described in glowing terms. We would not have its medicinal qualities under discussion, but would be satisfied to have it on our tables. If, however, we should now eat some of our poorer qualities of potato, such as were commonly grown for cattle a quarter of a century ago, we would see in the soggy and hard condition a root which might well have excited the admiration of Hawkins, and which would have suggested the parsnip or the carrot for comparison more than would a sweet potato.

(To be continued.)

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NOTES ON THE LABRADOR ESKIMO AND THEIR FORMER RANGE SOUTHWARD.

BY A. S. PACKARD.

(Continued from p. 481, May number.)

THE stone structures, particularly the grave or dolmen-like burial places referred to by the Moravians, are of course matters of very great interest. In connection with that statement we would draw attention to the following extract from "The three voyages of Martin Frobisher," second voyage, 1577, Hakluyt Society, London, 1867, p. 136:

"In one of the small islands here [near Lecester's Iland in Beares sound] we founde a tombe, wherein the bones of a dead man lay together, and our savage being with us and demanded (by signes) whether his countryman had not slain this man and eat

his flesh so from the bones, he made signes to the contrarie, and that he was slain with wolves and wild beastes."

Although it is generally stated that the Eskimo seldom if ever bury their dead, the foregoing statement would show that in early times at least they took pains to place the corpse in stone tombs. I found at Hopedale, in 1864, two skeletons, evidently Eskimo, interred in the following manner: while walking over a high bare hill north-east of the station I discovered a pole projecting from what seemed a fissure in the rock; it proved to be the sign of an Eskimo grave; the pole projected from the chasm, which was about fifteen inches wide and twenty or twenty-four inches in depth; the opening was covered by a few large stones laid across the fissure. At the bottom lay the remains of two skeletons entirely exposed to the elements, with no soil over them. The skulls were tolerably well preserved, and so were the long bones, but the vertebræ, ribs, &c., had mostly decayed. Judging by the way in which such objects are preserved in the open air on this coast, the burial must have been made at least over half a century ago, but more probably from one to three centuries since.

We now glean the following extracts from Hind's excellent Explorations in the Interior of the Labrador peninsula, which show that the Eskimo spread south-westward along the coast of Labrador as far as the Mingan islands.

Speaking of the Montagnais or coast Indians of Labrador, he writes: "Of their wars with the Mohawks to the west, and the Esquimaux to the east, between 200 and 300 years ago, there not only remain traditions, but the names of many places in the Labrador peninsula are derived from bloody battles with their bold and cruel enemies, or the stolid and progressive Esquimaux" (II, p. 11).

"The summit of the Great Boule, 700 feet above the sea, and the brow of the bold peninsula on the west side of the harbour [Seven Island bay] were two noted outlooks in the good old Montagnais times. They are not unfrequently visited now, when the Indians of the coast wish to show their country to the Nasquapees from the interior, and to tell them of their ancient wars with the Esquimaux. * * * They were able to hold their own against the Esquimaux in consequence of the almost exclusively maritime habits of the people, who rarely ascended the rivers further than the first falls or rapids: and they fearlessly

PLATE XVII.

An Eskimo family at Hopedale, Labrador. From a photograph.

pursued their way through the interior of the country as far as the Straits of Belle Isle and Hamilton inlet, but exercising the utmost caution as they approached the sea to hunt for seals" (p. 30).

Of the Mingan islands Esquimaux island was so named "because the Esquimaux were wont to assemble there every spring in search of seals," &c., &c. (p. 49).

"The ruins of Brest must not be confounded with those of the old Esquimaux fort some distance farther up the straits, and which are found on Esquimaux island in St. Paul's bay. These ruins, consisting of walls composed of stone and turf, remain almost entire to this day;[1] and on the same island are large numbers of human bones, the relics of a great battle between the Montagnais and French on one side and the Esquimaux on the other, which were found about 1840" (p. 130).

"At Fox harbour there is a small settlement of Esquimaux, who are now orderly and industrious Christian people, fruits of the faithful labours of the missionary at Battle harbour, who has resided eight years on the coast" (p. 198).

"Seals have been the chief cause of the wars between the Montagnais and Esquimaux of the Labrador peninsula, and most of the conflicts between these people have taken place at the estuaries of rivers known to be favourite haunts of the seal" (p. 204).

Regarding the Eskimo living near Caribou island, at the mouth of Esquimaux river, Strait of Belle Isle, in 1860 and several years after that date, the following information has been kindly given me by the Rev. C. C. Carpenter, for some years (1858 to 1865) a missionary to this part of the Labrador coast: "Concerning the Esquimaux ('Huskemaw,' old father Chalker at Salmon bay used to call them), in my time there was only one family living in the immediate vicinity of the mission, and that only a fragment—the Dukes family. They once lived at the extremity of Five League point. The husband (George?) died and the wife married an Englishman, old Johnny Goddard. She was a full-blooded Esquimaux, and could kill a seal by imitating its appearance in dress and cry, just as quick as the next man, and a good deal quicker if the other was white! She died at a great age about the year 1879. I was on the coast, after an absence of fifteen years, in

[1] Robertson of Sparr point.

1880, and was told that she was about 100 years old, but I deemed that an exaggeration. Her sons were George and Andrew, both now dead of consumption. I buried George at Middle bay in 1862. Andrew died since we came away. He had visited Halifax and had had his photograph taken; I have a copy of it; it is, however, of a dressed-up man, not my old Esquimaux friend. Both of the sons were unmarried. A daughter of old Aunt Jenny Goddard had a daughter, I think by an American sailor. She was called Lucy Dukes, and (her mother dying) was adopted by Mrs. Goddard. I dare say you remember her there at Stick Point island; she was lame. She married little Johnny Goddard, nephew of old John, and they with several children occupy the island home. She said to me in 1880, "There's my Jenny, just look at her narrow features; you know Granny had a very narrow face!" And yet an old sailor once said that the old woman's face was as flat as a barn door!

"There was another family of Esquimaux, whose residence was at St. Augustine; I cannot recall the surname. I used to see one, 'Louis the Esquimaux.' My impression is that one only of that family was living in 1880, for I brought home Esquimaux dolls in full dress made by her. These I feel sure were all the remnants living in my parish, say for fifty or a hundred miles up and down the coast.

"The Esquimaux in Southern Labrador are a remnant. Once powerful there and numerous, they were defeated in a battle fought on Esquimaux island (at the mouth of the river) by the Indians (Mountaineers), and what few were left went northward."

We observed on Caribou island traces of Eskimo occupation in the form of a circle of stones, like that observed farther north near Strawberry harbor.

Along the coast north of Hamilton inlet are a few Eskimo, half-breeds and probably remnants. At Roger's harbor we took aboard as pilot to Strawberry harbor one Cole, a half breed, part Eskimo and part Englishman, who had an Eskimo wife and two three-quarters-breed children; his mother was an Eskimo. There were formerly a few Eskimo living in this region, but they had died off rapidly within a few years past; our pilot from the States, Capt. French, who had frequented this coast for many years, said that there was now but one Eskimo where there used to be twenty. Their disappearance seems due partly to that of

seal, fish, birds and other game, and partly to contact with the civilization of this coast, their close winter houses inducing consumption and other chest troubles; but whatever the causes, the race is rapidly fading away, going by entire families. Cole was intelligent and could read and write.

On our way to Strawberry harbor we were boarded by an Eskimo who paddled up to our vessel in his kayak. He had been living in the bay during the summer. The next day I landed on a little flat islet near our harbor, and found traces of recent Eskimo occupation. An Eskimo family had evidently been summering there in a seal-skin tent. The marks of their temporary sojourn were the circle of water-worn stones which had been used to pitch the tent, the feathers and bones of sea-fowl which had been shot or snared, scattered bones of the seal and other unmistakable signs of Eskimo occupancy and of Eskimo personal uncleanliness. While here we learned that some Eskimo were spending the summer on an island hard by, and we tried to find one to pilot us to Hopedale, but were unsuccessful. We, however, obtained one who had received some education and was then living ten miles up the bay with a Norwegian in the employ of the Hudson Bay company, his pay being fifty dollars a year.

The number of Eskimo on the Labrador penisula is estimated at 1400, but this is probably an overestimate, as most of this race are now partly civilized and gathered at the Moravian Mission stations of Hopedale, Nain, Okkak, Zoar and Ramah.

At the time I visited Hopedale, which was in the summer of 1864, in the expedition of Mr. William Bradford, the well known artist, the Eskimo population of that station was about 200. It was reported to us that during the preceding March twenty-four Eskimo had died of "colds;" while at Okkak twenty-one had died, and the same number at Nain. Thus over a tenth part of the native population at these stations had died of chest diseases in a single month. This high death rate may be the result of their partial civilization and less hardy out-of-door life, but their houses are not very different from those their savage ancestors inhabited. The missionaries have wisely not attempted to force upon them European standards of living as regards dress and houses, and their system of trading with them as well as teaching them does not appear to have been accountable for this rapid decrease. On the contrary, anthropologists as well as humanita-

rians are under obligations for the success these devoted Moravians have had in preserving on American soil this interesting people intact, unmixed, and with some of their harmless and more interesting habits preserved. They are, however, doomed, judging by the past years' experience, to ultimate extinction.

As regards the longevity of these people, we understood the oldest person at Hopedale, the patriarch of the colony, to be a woman of seventy years; we saw her, a picture of uglinesss which still haunts our memory. There were three Eskimo who were sixty years old. A man becomes prematurely old when forty-five years of age, as the hunters are by that time worn out by the hardships of the autumnal seal fishery.

The Eskimo settlement of Hopedale, the only one we visited, was founded in 1782. It consisted in 1864 of about thirty-five houses, arranged with more or less disorder in three principal streets. They are mostly built of upright spruce logs with the bark still on, dovetailed at the corners and banked nearly to the eaves with turf on the outside; the roof rather flat, though irregular, with a skylight and small window in one side, either as in the case of the more well-to-do families consisting of a rude sash with four or six glass panes, or panes of the intestines of the seal sewed together.

The house is entered through a long low porch, probably the survival of an ancient style, *i. e.*, the low porch of their snow houses through which their forefathers crept on their hands and knees. On entering we were obliged to stoop low and to circumspectly make our way between the carcass of a seal or a codfish, as the case might be, and a vessel of familiar, democratic shape and use, filled with urine, in which the sealskins are soaked before being chewed between the teeth of the housewife, an important step in the process of making or mending sealskin boots; while Eskimo dogs of various sizes and colors blocked the devious way.

Across the end of the interior, which was floored with wood, and in which we could not stand erect, was a wooden bed or seat, a sort of divan, on which sat a woman in spectacles weaving a basket of dried rushes which had been colored blue or red; she nodded a welcome and made us feel quite at home. The other belongings of the house were a hearth or fire-place of a few pebbles situated on one side, a soapstone lamp which was a

flat oblong dish, carved out of soapstone, of normal Eskimo design; some knives of European manufacture, needles and thread, while on a shelf we noticed an Eskimo Bible with the owner's name written in a neat hand on the fly leaf. On the whole the interior was neater and less offensive to the eye and nostril than we expected, as was the exterior. Besides the house, on a cross-pole supported by two uprights, rested a kayak, and over another horizontal pole hung drying a black bear's skin or dried cod-fish, as the case might be. The spaces between the houses were rudely drained, and saving the usual refuse heap at the rear of the house, a dog's carcass, fish bones and other rejectamenta, there was nothing particularly repulsive, though certainly nothing attractive about the houses. Two families sometimes live in the same house, which is partitioned off simply by a low rail passing through the middle. We do not remember seeing any babies, and there seemed to be few children compared to the adults; here as in the arctic regions the Eskimo having small families.

The women's dress differs from that of the Greenland Eskimo in the much longer tails of their jackets, which as seen in Pl. XVII nearly reach to the ground; by the Greenlanders it is worn but little longer than the men's; this difference, as seen on p. 473, was remarked by Cranch. Of late years woolen goods have partly superseded sealskin, but the pattern has been retained. Another difference is the form of the kayak; that of the Labrador Eskimo is much broader than the Greenland kayak, and of clumsier build, since the frame of the former is made of spruce; this renders the Labrador kayak perhaps safer.

So far as we could see the Labrador Eskimo at and north of Hopedale are full-blooded. Our engraving (Pl. XVII) is from a photograph taken by Mr. Bradford, and gives an excellent idea of a Hopedale Eskimo couple with their baby. The faces apparently show no trace of foreign blood, while there is said to be not a full-blooded Eskimo in the Greenland colony, the intermixture with the Danes and Scandinavians in general being thoroughgoing. Few Europeans or Americans had previous to 1864 visited the Labrador coast north of Hopedale, and there the race has been preserved in most cases intact, though there may now be an occasional intermixture with the Newfoundland fishermen, who now go as far as Nain.

As to the number and distribution of the Eskimo north of the

Moravian stations, we now have some definite information from Lieut. Gordon's report of the Hudson's Bay expedition of 1884. He says: "I cannot help thinking that their numbers have sensibly diminished, inasmuch as we found signs of their presence everywhere; yet except at Port Burwell, Ashe inlet and Stupart's bay, none were met with. About six miles south of Port Burwell [Cape Chudleigh] there are the remains of what must once have been a large Eskimo settlement, their subterranean dwellings being still in a fair state of preservation. At the present time, so far as I can learn, there are only some five or six Eskimo families between Cape Chudleigh and Nachvak.

"Along the Labrador coast the Eskimo gather in small settlements round the Moravian Mission stations; at these places their numbers vary considerably. Nain is reported to be the largest settlement, and its Eskimo population amounts to about 200 souls" (p. 16).

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THE INTER-RELATIONSHIPS OF ARTHROPODS.

BY J. S. KINGSLEY.

IN most of the schemes of classification in vogue to-day the Arthropods are divided into two groups of equal rank, the first being the Crustacea, the second embracing the Tracheata or Insecta. Having recently studied the embryology of Limulus, and finding it necessary to ascertain its place among the arthropods, the writer was led to compare, in a critical manner, the various groups. This led to somewhat unexpected views as to the various inter-relationships of the different "types" (if that word may be pardoned), and as the results may prove of interest, a short résumé is here presented in advance of the full article which will appear in the *Quarterly Journal of Microscopical Science* for October.

It might be stated here, parenthetically, that upon a large number of points regarding the arthropods, and especially the so-called tracheates, our knowledge is extremely deficient. For this reason some of the following account is merely tentative, the probability being in favor of the views here adopted.

First, we may take up the relationship of Limulus to the spiders. The view first suggested by Strauss-Dürckheim and lately so ably supported by Professor E. Ray Lankester, that Limulus is not a crustacean but an arachnid, receives full confirmation from the

development of the king-crab. The introduction of this form into this group seems to necessitate a new term for the whole, and I have adopted the name Acerata for the arachnids and the merostomes, in reference to the absence of antennæ. It is but a slight modification of the word Acera, used many years ago by Latreille for the spiders alone. The term Arachnida still retains its former significance.

As here limited, the Acerata may be defined as arthropodous animals with the body divided into two regions (cephalothorax and abdomen), the cephalothorax bearing six pairs of primitively post-oral appendages. The number of abdominal appendages vary, but four or more are modified for respiratory purposes; respiration being performed by gills, "lungs" or tracheæ, the homology between these three types of organs being easily traced. The genital ducts empty at the base of the seventh (first abdominal) appendages and paired segmental organs open, in the young, at the base of the fifth pair of limbs, but lose their excretory duct in the adult. The genital glands are branched and the branches communicate through numerous anastomoses. The liver is large and voluminous. The development is direct, no metamorphosis being introduced.

Some of these points may require explanation, and while I would refer the reader to the paper on the embryology of Limulus for details, I may here mention a few facts. My studies on the development of the gills of the king-crab when compared with those of Metschnikoff on the scorpion and those of Salensky on the spiders, show that the lungs of the one and the gills of the other are (as was suggested by Lankester) perfectly homologous. They arise as foldings at the base of appendages, occupying the same position serially in both Limulus and the scorpions. Leydig showed, some thirty years ago, that the tracheæ and pulmonary sacs of the spiders were homologous organs, and in later years the same has been pointed out by Bertkau and Macleod. One very important point should here be noted. In the spiders the stigmata or external openings of the tracheæ or pulmonary sacs never occur elsewhere than on the abdomen, and they always perforate the sternal plates. In the hexapods they occur in all parts of the body, and always on the sides and never on the ventral surface.

The so-called coxal glands or, as I regard them, segmental

organs, have only recently been known. Packard first found them in Limulus, and later Lankester made an exhaustive histological study of them in comparison with similar glands occurring in the scorpions. Neither of these authors were able to find any external duct. More recently Bertkau has found that in the young spider they open externally at the base of the fifth pair of appendages (third pair of legs), but this duct is lost in the adult. The studies of Mr. Michael on the coxal glands of mites are, so far as they go, confirmative. In Limulus I found that they arose as coiled mesoblastic tubes, closely comparable to the segmental organs of worms, and emptied in the young at exactly the same point as in spiders.

It seems to me that these various points show that the Acerata are more closely allied to the Crustacea than to the hexapods and myriapods with which they are usually classed. Lankester has shown from a study of Apus that all of the crustacean appendages are primitively post-oral, a fact which is confirmed by the study of the development of various forms. With this point settled it would appear that we have a perfect right to compare, within certain limits, the segments and their appendages of spiders and crustaceans. Tabularly arranged, the result would be somewhat as follows:

Crustacea.	Acerata.
I. Antennula.	Chelicera.
II. Antenna.	Pedipalpus.
III. Mandible,	Leg I.
IV. Maxilla 1.	Leg II.
V. Maxilla 2.	Leg III.
VI. Maxilliped 1,	Leg IV.

That this serial comparison is legitimate is shown by several reasons besides that given above. In the Acerata the series embraces all of the cephalothoracic appendages. In the Crustacea it stops exactly at the line of division between the so-called head and thorax of the tetradecapods as well as in the embryos of many other forms. A further point is interesting. In many of the lower Crustacea a pair of so-called shell glands occur which are regarded by Claus, Grobben and others as comparable to the segmental organs of worms. The outlets of these organs occur at the bases of the second pair of maxillæ, a position which the above table will show is exactly comparable to that of the outlet of the coxal glands of Limulus and the spiders. In many Crus-

tacea another pair of glands occur, the antennal or green glands which also appear to belong to the same series.

A further point is also to be mentioned. In both Acerata and Crustacea the genital ducts open at the base of a pair of appendages near the middle of the body, and although that exact homology is lacking as to position which is seen in the case of the segmental organs, still there is enough similarity to make one think that here, as well as in other forms, a pair of segmental ducts has become modified to subserve the purposes of the genital system.

Did space allow, these comparisons could be prolonged almost indefinitely, showing that while there is a general resemblance between the Acerata and the Crustacea, there exists a much closer one between Limulus and the arachnids. If we turn now to a comparison of the Acerata, or even the arachnids proper, with the hexapods, we are at once struck with the important differences between them; differences which prove that the two groups have but little in common, and that, so far as these two are concerned, the division Tracheata is an artificial and not a natural one.

We have already alluded to one important difference between the tracheæ in the two groups. A few other remarks may prove of value. Tracheæ are internal tubes for conducting air to the tissues of the body. They are not confined to the "Tracheata" but occur in some of the terrestrial Crustacea. This was first pointed out by Lereboullet in 1851 in the sow-bugs (Oniscidæ), and more lately it has been shown that these tracheæ which are developed inside the branchial lamellæ are lined with a cuticle which is raised into folds, comparable to the so-called spiral filament in the tracheæ of the hexapods. The inference to be drawn is that tracheæ in the arthropods are not of phylogenetic significance, but have arisen from a necessity of conveying air to the blood and tissues in an air-breathing form. The thickenings of the cuticular wall, whether spirally or irregularly arranged, are intended to prevent the collapse of an otherwise delicate tube.

In both spiders and hexapods there are developed from the hinder division of the digestive tract excretory organs which are known as urinary or Malpighian tubules. The writer holds that these are not to be regarded as indicating any especial affinity between the two groups, but like the tracheæ are produced by

environment; though it must be admitted that the reason why a terrestrial life should cause the development of these organs is not as easily explained as in the case of the tracheæ. In proof, however, of the point made, it may be stated that in those amphipods which like Gammarus and Orchestia are more or less terrestrial in habit, similar tubes are developed from the same portion of the alimentary canal, and further that their size and length is directly proportional to the more or less terrestrial habits of these forms. The same is apparently true of some of the isopods, though on this point our information is deficient.

Another point usually emphasized is the fact that in the Crustacea a biramose condition of the appendages occurs while this is not known in the "tracheates." The studies of Lankester on Apus have shown how this biramose condition arose, and the fact that frequently it is lacking in the Crustacea would tend to indicate that it might have existed in the ancestors of the "tracheates" and have been lost in the present forms. Even more important is the fact that such structures are not unknown in the "tracheates." They occur, as James Wood-Mason has shown, in the thysanures, and Patten has described a similar state of affairs in the embryos of the cockroach.

So far as our present knowledge goes we can say nothing as to the primitive position of the antennæ of hexapods; whether they be processes of the procephalic lobes somewhat like those of Peripatus or appendages which originally belonged to the postoral series and which have moved forwards to a pre-oral position as have the similarly named appendages of the Crustacea. In the former case the differences in this respect between the hexapods on the one hand and the Crustacea and Acerata on the other will be seen to be very great. If the other view prove to be the true one, these organs of course will have less importance from a taxonomic standpoint. Still the differences will be very marked. That the former view is correct I am inclined to believe. If we accept it and regard the antennæ as something entirely represented in spiders and Crustacea and then make a serial comparison as before, the result is as follows:

HEXAPODA.	ACERATA.
I. Mandibles.	Chelecera.
II. Maxilla.	Pedipalpus.
III. Labium.	Leg I.
IV. Leg I.	Leg II.
V. Leg II.	Leg III.
VI. Leg III.	Leg IV.

This comparison brings the beginning of the abdomen in the same position in each group, but we have no other features to test its validity as we had in the case of the Acerata and Crustacea. In the hexapods there is nothing which in any way resembles a segmental organ.

The hexapods have no liver, an organ voluminously developed in Acerata and Crustacea; their genital ducts terminate at the end of the body, and no evidence as yet presented points to the conclusion that they are to be regarded as modified segmental organs.

With regard to the myriapods the problem is more difficult, and our knowledge of the development is too scanty to throw much light on the subject. The attempt has often been made to homologize the mouth parts in the two groups, but as yet with not very satisfactory results. A few morphological facts may prove suggestive. As is well known the myriapods are divided into two groups, Chilopoda and Chilognatha, represented by Scolopendra and Julus respectively. In the Chilopoda the genital ducts terminate at the end of the body beneath the anus, in the chilognaths near the anterior end of the body, in a position almost comparable to that in the Acerata. In the chilopods the stigmata occupy the same position (between the dorsal and ventral plates) as in hexapods, but in the chilognaths they may occur on the ventral plates or even in the bases of the legs. Apparently in both groups the antennæ are pre-oral in position; in the chilognaths their nerves arise in advance of those to the optic organs.

In this connection more knowledge, especially of the head, is desirable concerning the curious fossil myriapod, Acantherpestes, described by Mr. Scudder. Scolopendrella will also repay investigation. In these forms, between the bases of the legs are the openings of peculiar organs. Mr. Ryder regarded those of Scolopendrella as tracheal stigmata; Mr. Scudder those of Acantherpestes as supports for branchiæ. It may turn out, indeed it is probable, that both are the outlets of segmental organs.

The few facts here presented, when taken together with the preceding remarks on tracheæ and Malpighian tubes, would allow the supposition that the myriapods may have but little relationship with either hexapods or spiders, and even that chilopods and chilognaths are not so closely connected as is usually supposed.

The discovery by Moseley of tracheæ in Peripatus at once transferred this form to the tracheate phylum, and much was expected from it as throwing light on the origin of the other air-breathing arthropods. To the writer it does not appear to have any close relationship to any of the other "tracheata," but still most of all to the chilognaths. Still it is not proven beyond a doubt that it is an arthropod at all.

The so-called antennæ are always pre-oral (as shown by Kennel in the embryo and Balfour in the adult), and receive their nerve supply from the procephalic lobes in advance of these nerves to the eyes; thus allowing one to compare them with the pre-oral appendages of worms. The tracheæ and stigmata are not metamerically arranged, the latter opening more or less irregularly over the surface of the body and legs. The legs themselves are not distinctively arthropodous, while the numerous segmental organs indicate, as has often been pointed out, a very primitive form. Indeed, one has but to imagine a Syllid worm to leave its natural element and take to the land, losing the setæ of its parapodia and developing claws at their extremities, losing its median antennæ and developing tracheal pits for respiration and salivary glands to moisten its food, and Syllis becomes Peripatus. The other changes would be few. It would still retain its lateral tentacles, its segmental organs, its peculiar sympathetic nervous system and many details of its digestive tract. In fact Peripatus, in the light of recent studies, appears nearer the polychætous annelids than to any of the arthropods unless possibly the chilognathous myriapods.

Recapitulating now the results of this hasty sketch, we arrive at the following conclusions: Peripatus has departed the least from the ancestral annelidan stock, the hexapods the farthest. These then will form the extremes of the series. The Acerata and Crustacea should be placed near each other, but which is the higher is a question. For instance, in the one only one pair of segmental organs remains, and these have lost their external ducts, while in the other group two pairs of these organs are functional through life. On the other hand, two of the post-oral ganglia of the Crustacea have moved to a prestomial position and have joined the supra-œsophageal ganglion, while in the Acerata but one ganglion has been completely transferred and this has not yet become wholly united with the ganglion formed

by the procephalic lobes. The position to be occupied by the myriapods can only be decided by further study.

As will be seen, the points requiring further investigation are many. We at the same time know more and less of the arthropods than of any other group of the animal kingdom, unless it be of the birds. The literature descriptive of the species of insects is enormous, but when one tries, for the purpose of exact comparison, to find out from books some of the simplest points of tracheate anatomy, he is met with only vague and generalized statements or with no information at all. It may be that further study will show that the conclusions reached above are founded on insufficient data, but we think it must be admitted that so far as Crustacea, Arachnida, Limulus and the hexapods are concerned, the points here made are well sustained by our present knowledge. What is especially needed is a more exact knowledge of the arthropodan brain. The papers of Newton, Dietl, Flögel, Brant and others are good, so far as they go, but unfortunately they leave many and the most important points undecided. The same may be said of almost every other point in arthropodan anatomy except the morphology of the appendages, and even on this point much work remains to be done.

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HOW THE PITCHER PLANT GOT ITS LEAVES.

BY JOSEPH F. JAMES.

OF the many curious plants which have been given to the world by America, the pitcher plants are among the oddest. They form a family which belongs entirely to the new world, where the species are widely dispersed. One of them is found in South America, one in California, while the others are natives of the Atlantic seaboard. A single one of these extends northwestward to Minnesota and British America. The feature which is common to these widely-scattered forms is the hollow leaf, making a sort of pitcher into which insects fly or fall or walk.

When a leaf departs as far from the normal shape as does the leaf of the Sarracenia, it is always interesting work to try to discover the causes which have lead to the divergence. To do this it is necessary to go far back in the history of the world and find an ancestral leaf from which it could have come. This necessitates the examination of the various allies and relatives of the

plants, for by so doing it is often possible to find the line along which they have descended. It seldom happens that all traces of this line have been destroyed. Here and there a faint or obscure mark gives a clue; one thing leads to another, until at last it becomes easy to trace the line of development to the original starting point. To do this it will first be necessary to give some account of the pitcher plants now living in the new world.

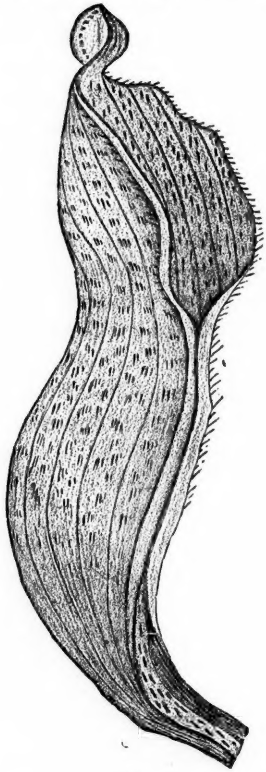

Fig. 1.

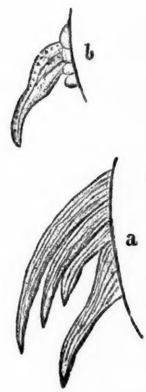

Fig. 2.

FIG. 1.—Leaf of Heliamphora. FIG. 2.—Hairs of Heliamphora; *b*, from base; *a*, from top.

The simplest form of leaf in the family is found in Heliamphora, a native of Venezuela in South America. It is a hollow tube with a narrow opening extending nearly one-fourth the way to the bottom, and with a small rudimentary hood at the top (Fig. 1). Nearly the whole of the interior of the leaf is lined with hairs, those at the bottom long and slender, and those at the top short and thick (Fig. 2). They do not seem to be either

secreting or absorbing hairs, but serve simply to prevent the escape of insects which have once found their way inside. This may be regarded as the nearest living equivalent of the original and ancestral form, but even it has, of course, been greatly modified to suit altered conditions.

FIG. 3.—Leaf of *Sarracenia purpurea*.

Next in order, but a little more modified, comes the widely dispersed Side-saddle flower (*Sarracenia purpurea*) of the bogs of the Eastern and Northern United States. In this species the leaf forms a more perfect tube, open only at the top, and surmounted

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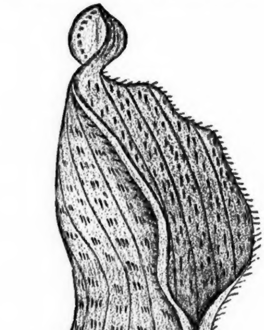

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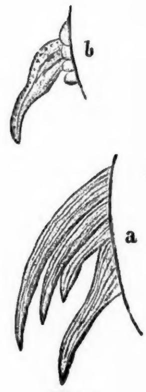

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on one side by an upright hood (Fig. 3), the inner surface of which is thickly covered with short stiff hairs, all pointing downwards. The interior surface at the bottom of the hollow is lined with slender bristles (Fig. 4). These extend about one-third of the way up. Then comes a perfectly smooth, glaucous surface, extending another third of the way, and above it is another set of hairs similar to those on the hood. In this leaf there is a marked advance in development over the first one. The hollow is more complete; the hood is larger and more conspicuous and attractive; the smooth surface at the center of the hollow is a more effectual safeguard against the escape of insects, and the plant is in every way better adapted to secure insect prey. Still the pitcher is open to the rain, secretes little or no nectar, and absorbs the juices of the insects it captures in the form of a liquid manure only.

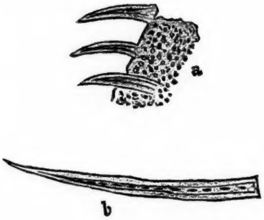

FIG. 4.—Hairs of *Sarracenia purpurea; b*, base; *a*, top.

The next step in advance is found in a southern species of the genus with larger and more upright leaves, known as *Sarracenia flava.* The arrangement of the hairs in the interior of the leaf is the same; but a saccharine secretion just below the hood shows a marked difference, and is a more effectual lure to insects than merely a colored surface such as there is in the species previously referred to. The provisions for the retention of insects are equally good in both species, but in the *flava* a secretion of honey acts as a bait. It seems to possess, too, a slight trace of a deleterious quality.

FIG. 5.—Leaf of *Sarracenia variolaris.*

The fourth round of the ladder is *Sarracenia variolaris* (Fig. 5), and here is found a wonderful advance in structure. In the first place the hood bends over the orifice of the leaf and shuts out all rain. Secondly, the hood is marked on the posterior portion with white translucent spots and reticulations, and honey is there secreted. Thirdly, the fine velvety pubescence extends one-third way down the pitcher, and then the hairs become longer, coarser

Fig. 6.

Fig. 7.

Fig. 6.—Leaf of Darlingtonia. Fig. 7.—Hairs of Darlingtonia; *b*, base; *a*, top.

and more bristly as the tube narrows. Fourthly, a secretion is formed at the bottom of the pitcher which has the peculiar property of asphyxiating insects so unfortunate as to fall into it Fifthly, there is found to be a honey-baited pathway running from the ground up along the wing of the leaf to the hood, and a short way into the orifice.

These are many and curious changes. A marked advance

over the open, honeyless pitcher of *S. purpurea* is at once manifest. But a still further advance is found in Darlingtonia, the third genus of the order and a native of California. In this the leaves are very long, stand upright and have a peculiar twist not found in any other species (Fig. 6). The hood, in addition, forms a vaulted arch, mottled with spots and reticulations. The only entrance to the leaf is from below, and on each side of this entrance is a long appendage, the whole likened to a fish tail. The inside of this secretes honey and is covered with hairs. The interior of the pitcher is lined with vast numbers of hairs, which become longer and more bristly toward the bottom (Fig. 7). A secretion is found here that has the power of decomposing the bodies of the insects which have been entrapped. On the outside, running along the wing, from the ground to the orifice, is a honey pathway which lures creeping insects to their destruction. The wings or fish-tail, at the top of the pitcher, attract flying ones.

In these species of plants there is a regular gradation from the simple to the complex. From the Heliamphora with its open pitcher and small hood, to the *Sarracenia purpurea* with upright, less open pitcher and larger hood; thence to the *S. variolaris* through several stages of less complexity, with its almost closed pitcher, power of secreting honey and digestive fluid; then to the more remarkable Darlingtonia, with its large twisted leaves, with vaulted hoods and fish-tail appendages, decomposing fluid and honey-secreting apparatus. Scarcely any of the steps showing the progress are needed to complete the line of development. It can be traced directly from Heliamphora to Darlingtonia, and it is only necessary to have an ancestral form from which to start to have a complete pedigree.

It seems probable that the water-lily family and the pitcher-plant family had a single ancestor in common. This ancestor was aquatic, or at least an inhabitant of swampy places. It had small, probably peltate, perhaps reniform leaves, and these had hollow petioles. The inner space was lined with hairs as are now the inner surfaces of the stems of Nymphæa and its allies; it had a four or five parted flower, with many stamens and a broad stigma.

From such an ancestor came two or three branches. One of these developed into plants having an aquatic habit, large leaves

and long petioles, and peduncles like those which are found at present in the water-lilies. The other branch diverged to form plants living in boggy or swampy grounds, with pitcher-like leaves whose insectivorous proclivities were developed later on.

The development of the members of the water-lily family from this hypothetical ancestor can be accounted for thus. The aquatic habit must be confirmed, the depth of water increased, the leaves grow larger and the change is complete. But to transform a peltate or reniform leaf into a pitcher requires much more modification. Suppose, however, that water lodging on the upper surfaces of some leaves was retained there; and that in this water insects were caught and drowned. Suppose the constant presence of the water caused the decay of the substance of the leaf at its insertion on the petiole and allowed the water to penetrate the hollow. This liquid manure might assist the plant in its growth. The habit of catching water by means of a peculiarly cup-like leaf, would be transmitted from generation to generation. Each successive one would have larger and larger petiolar spaces, and correspondingly smaller leaves. And this because the liquid manure supplied directly to the root would enable the plant to do with less and less leaf surface as the nutriment was more and more fully elaborated; until finally the petiole would have grown into a hollow pitcher-like affair, and the leaf-blade would have dwindled to a rudiment.

The primitive pitcher plant was probably but little less specialized than the least one now known. This one has already been described under Heliamphora. The various modifications of structure incident to change of form now come under consideration.

FIG. 8.—Internal hairs of water-lily.

The internal hairs of modern water-lilies were likely represented in the ancient form from which they are descended. In species now living these hairs are stellate, with from three to five arms or projections (Fig. 8), and they thickly line the interior spaces of the petioles of leaves and the peduncles of flowers. Exposure to air and adaptation to altered conditions would naturally cause a change of form. They doubtless lost first one and then another

projection, till they were reduced to a single one. This one would be, at first, of the same size and shape the whole length of the pitcher. Then, in time, as it was found that those at the bottom would not need to be so strong, they would become longer and more slender, while the uppermost ones would be stiff and harsh to more effectually prevent the crawling up of insects. As the specialization proceeded, a less number of hairs would be required and a smooth space near the center of the wall of the leaf would be found a still more effective guard against the escape of the prey.

FIG. 9.—Heliamphora.

As soon as the capture of insects became a necessary part of the existence of the plant, or even an advantage to it, honey would be developed to serve as an attraction. This, from at first a merely sweet secretion, would acquire, if it served a useful end, a character calculated to retain the insect. If, however, the honey had too bad an effect, the end in view would be defeated, for it would in time be rendered unattractive. For insects would in their turn, become modified to resist the temptation. So then the next step in the onward march would be to keep the honey of the lure pure, but to modify the character of the secretion at

the bottom of the pitcher so as to retain and eventually convert the insects caught into nutritious material for the plant. This secretion would become a further necessity, and its character would be otherwise changed when, by a change in the nature of the hood, rain was excluded from the cavity. Finally, as a further lure to insects appendages brightly or curiously colored would arise and assume a form calculated to attract them.

That these were the steps leading from the simplest to the most complex form of pitcher is shown in the actual forms living to-day. There can hardly be a better illustration of the theory of descent with modification than is found in this one family. It becomes, therefore, a matter of peculiar interest to still further continue the study, and to investigate the causes which led to the peculiarities of the flowers they possess, and likewise to study the reasons for their present geographical distribution.

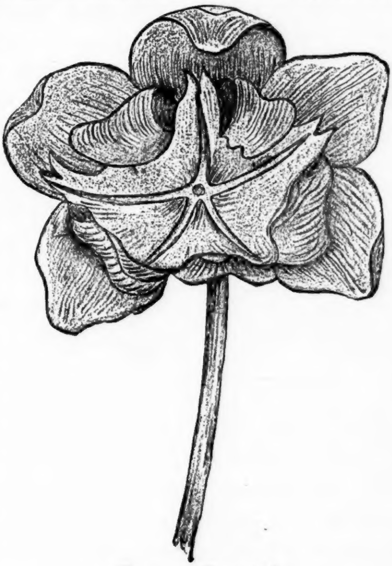

FIG. 10.—Sarracenia.

The flowers of Heliamphora are described as being regular, with four, five or perhaps, at times, six sepals, no petals, an indefinable number of stamens, and a single, entire pistil (Fig. 9). There are one or two flowers on a bracted scape. In the flowers of all the species of Sarracenia a peculiar modification of the pistil is observed. Along with the five sepals and five petals, it is found that the pistil has assumed a broad, umbrella-like shape (Fig. 10) with the stigmatic surfaces at the ends of the rays. These are five in number and extend upwards as the flower hangs. A single flower is at the top of a naked scape. The flower of Darlingtonia (Fig. 11) is solitary at the top of a bracted scape, has five sepals and five petals, only twelve or fifteen stamens and a style with a five-rayed stigma.

In the first of these, the South American form, is probably to be found the nearest approach to the original type of flower. The single floral envelope, indefinite number of stamens and simple pistil, seem to indicate a comparatively unspecialized form, which corresponds to the simplicity of the leaves. In the modern Nymphæa or water-lily, there is a great number of petals, but these could be readily regarded as some of the numerous stamens of a few-sepaled or petaled flower which have been transformed into petals. In the ovary of Nuphar (spatter dock) there is an approach to the simple ovary of Heliamphora, accompanied, to be sure, by modifications which may be regarded as necessitated by an aquatic life. So that it does not require much to assume that in the flowers as in the leaves, the water-lilies and the pitcher plants are closely allied.

FIG. 11.—Darlingtonia.

The umbrella-like stigma of the side-saddle flower, as well as its whole arrangement, is to be regarded as a modification incident to cross-fertilization; for in these plants seed is not perfected otherwise. On this account alone it would be expected to diverge widely from the primitive form. But there is, in the closely allied poppy family, an approach to this spreading umbrella-like stigma, whose whole large expansion may undoubtedly be referred to the necessity for cross-fertilization.

Lastly, in the Darlingtonia the flower is also greatly modified. This time the change has taken place in accordance with changes in the leaves. The analogy between the fish-tail appendages of the leaves and the peculiarly spreading petals of the flower has been pointed out by Dr. Hooker. As both are of the same color and bear considerable resemblance to each other, he suggests that their development has proceeded together, and that while

one attracts the insects for purposes of fertilization, the other, by its imitative powers draws the visitor to it and is thus enabled to feed itself. Nor is such a suggestion an unreasonable one when the highly specialized condition of the plant is considered. If once a hint in that direction showed itself, and any benefit was thereby derived, it may be considered as certain that the direction would be persevered in until both leaves and flowers had departed very far from the original and normal type. This is exactly what has happened.

Coming finally to the geographical distribution of the order, the facts show plainly how one could have been derived from the other. The original home of all was most likely in South America, where one species still lingers. This original form may be imagined as conveyed from its place of origin to the south coast of what is now the United States, most likely by means of the Gulf Stream. Finding a suitable place for living, the somewhat changed conditions would have modified the emigrant into a plant with a leaf like *S. purpurea*. This once fairly established spread all over the country where there were favorable conditions for its growth. If we imagine this dispersion to have been during the continuance of the Tertiary period, there would have been ample time for great modification to take place. Then it was, in all likelihood, that the Darlingtonia began to develop in its own way. After a long period of time the Tertiary epoch was brought to a close. A great change came over the face of the country, and many of the intermediate forms between Sarracenia and Darlingtonia became extinct. Change in climate and in conditions produced by the glaciers which covered the country at one time was an efficient agent of extinction. At the same time the unextinguished forms would have continued to become modified in various ways until they became as they are now found.

The history of this one family, peculiarly circumstanced as it is, shows the possible origin of a number of forms from one common ancestor, different though they are from each other at present. In every part can be traced the workings of evolution. In leaf and in flower the steps can be followed. Even in the geographical distribution of the living species it can be seen. In some families of plants the steps are not so plain because encumbered by a larger number of generic and specific forms; but

could the gaps be filled in any one species or order, the line of descent might be followed through the ages to one common and generalized type. The varied forms to which that type gave rise are seen in the different genera of different natural orders. The time is far distant when all these can be traced step by step to their remote origin. But every little adds, and eventually a monument will be raised which will tell how, and perhaps when, each individual plant reached its present state of perfection or degeneracy.

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AN ADIRONDACK NATIONAL PARK.

BY WILLIAM HOSEA BALLOU.

A PROPOSITION to convert the Adirondack region into a national park, ought only to need suggestion. The only portion of the public domain which has been set aside as a national park is located in the distant mountain regions of Montana and Wyoming. East of the Rockies and within a territory of four million thickly populated square miles, not a single national breathing ground exists. In the great Empire State lies an elevated country of vast area, as lovely as the mind of man has mental imagery to conceive. It stands to-day the prey of timber thieves and game butchers, so neglected by the State that its boundary lines have been lost, its forests denuded, its waters left to evaporation and outrage, and its maintenance denied of all but the smallest pittance. It is the particular surface of the globe that gives one a glimpse through the corridors of time. It is a part of the cradle of the earth. Here are blue-gray hypersthene and contorted gneiss rocks—the first forms in nature's attempts at world building. Before organisms came into existence these rocks formed their part in the stable foundation of the earth. The Adirondack region, then, is grandparent to the remainder of the globe. The Hudson, which rises in its clouds, is perhaps the oldest river in existence, being the ancient outlet of the Great Lakes' ancestor, and hence the grandparent of waters. Will any one say that the Government of the United States ought not to be charged with the care of the portions of these aged relics which a great State has given over to weeds and bandits?

Two great watersheds lie within the State of New York at right angles to each other. They so interlock that writers have

been led to regard the State as one watershed. The dividing lines are too apparent, however, and the physical, climatic and geological differences necessarily form divisions of the State.

The eastern or Adirondack watershed runs almost north and south, throwing its waters north into the St. Lawrence, and south into Long Island sound. The western watershed runs nearly east and west, at right angles to the Adirondacks. It throws its waters from the interior chain of lakes, north into Lake Ontario. Its southern drainage flows at oblique angles into Chesapeake bay and the Gulf of Mexico.

The northern drainage of the western watershed occupies seven thousand square miles of territory, of which four hundred square miles are of lake surface, under the names of Oneida, Cayuga, Seneca, etc. This watershed has been made subservient to the necessities of commerce and industry. Besides being natural reservoirs, its lakes have been regulated to maintain a uniform flow through the Oswego river of six hundred thousand cubic feet of water per minute, during all seasons of the year. Seven dams on this stream, constructed by the state, provide hydraulic advantages equal to 140,000 horse-power. Thus the western watershed, by fostering gigantic industries, valued at millions, repays the State for the expenditure involved in its care.

The Adirondack watershed is of a different nature; its waters are of little commercial or industrial importance. Its rivers, the Moose, Beaver, Grass, Raquette, Salmon, Au Sable, Oswegatchie and others are high, turbulent and destructive in the spring. In the summer they are dry. The Hudson itself would be insignificant were it not an arm of the sea, scoured out and kept deep below Albany by the tides.

The Adirondack region has resisted all attempts at cultivation, otherwise it would be largely populated. Its mission is of higher importance to man than that of a mere industrial and commercial utility. Here is one of nature's great laboratories for the generation of pure air and the maintenance of stable atmospheric conditions. Its many cool lakes and babbling brooks form a natural resting and invigorating ground. It comprises the highest land in the State, ranging from one thousand to five thousand feet in elevation.

In this elevated domain are upward of two thousand lakes and lakelets abounding in clear cold waters—the ideal land of the

poet and the artist. The wild deer laves in the mirroring lake or lies sequestered in the deep ravine. The trout break the placid surfaces at night and the note of the whip-poor-will echoes from valley to peak through wood and clearing. The catamount watches from the creviced rocks and the black bear hibernates in the recesses of the forests. This is nature's miniature park of the earth. The mountains, cascades, rivulets, lakes and precipices are all scenic features in miniature. It is not a Yellowstone park. There are no three-mile vertical projections into space, no spouting geysers, no vast areas of sage brush, no great obsidian cliffs, no fossil forests, no bad lands of towering buttes and no bottomless cañons. All such awful sublimity is here molded in miniature—a playground of the gods.

Until the State survey began its work, ten years ago, but little was known of the Adirondack region. The only maps in possession of the comptroller were some curiosities made by colonial and early surveyors. So uncertain were the boundary lines that the State lost thousands of acres of lands, and was uncertain of any of its possessions. Investigation developed the fact that the State lands were first sold for little more than five cents per acre. The timber was immediately cut and the land allowed to lapse to the State for unpaid taxes. Wherever the second growth became valuable the lands were repurchased at tax sales, denuded and again left barren for the State, which now owns about eight hundred and ninety-five square miles. The watershed comprises about three thousand square miles which are available for park purposes.

The highest point in the State is Mt. Marcy, in Essex county, which rises 5344 feet above high tide. It is the monarch of the Adirondacks. Mt. MacIntyre, 5112 feet, approximates this altitude. Seventeen peaks exceed 4500 feet, forty-four rise above 3000 and seventy between that height and 2000 feet.

Mt. Washington, with its bridle-path and its inclined railway, has long enjoyed a monopoly in the East. A change is approaching. A new star has appeared in the sky. It is Mt. Marcy—nature's colossus to a noble name and the most ideal mountain on the face of the globe. It is no mere stone heap. Resting on its bosom are great forests, lofty spurs, precipices and lakes. Here also is Lake Tear-of-the-clouds, within one thousand feet of the summit—the supra-cloud source of the Hudson. It is the high-

est water in the State. The poetic State surveyor, Mr. Verplanck. Colvin, best describes it in these words :

"A few summers since I stood for the first time on the cool mossy shore of the mountain springlet lake, Tear-of-the clouds Almost hidden in the gigantic mountain domes of Marcy, Skylight and Gray peaks, this lovely pool lifted on its granite pedestal toward heaven, the loftiest water-mirror of the stars; beseeching, not in vain, from each low-drifting cloud some tribute for the sources of the Hudson; fresh, new, unvisited save by the wild beast that drank; it was a gem more pure and delightful to the eye than the most precious jewel."

Mt. Marcy is the center of the scenic, sporting, artistic, poetic and scientific interest in the Adirondack region. The timber limit is here well defined at 4900 feet above the sea. The crevices are densely filled with stunted evergreen and the deep valleys between the mountain crests are covered with forests of pine, spruce, hemlock, beech, birch and other trees. Snows are almost perpetual here, summer lasting but two months. So far as may be judged by one who has visited each, there is little difference in temperature and climatic conditions between an altitude of 5000 feet on Mt. Marcy and 12,000 feet elevation in Wyoming. This similarity may be accounted for by means of the ameliorating influences of the Pacific coast on the Rocky mountains. Mt. Marcy is beginning to attract many visitors and is certain to draw heavily on the traveling public as soon as its grandeur and attractions become more generally known. It was seldom scaled until in 1875 the State survey projected a line of levels to its highest point. Since then there has been a gradual increase of summer visitants. The Indians called Mt. Marcy Ta-ha-wus, signifying "I cleave the clouds."

Observations tend to show a considerable decrease of rainfall in the State. This decrease has been attributed to the general denuding of forests in the Adirondacks. The iron industries alone have been shown to consume the wood on six thousand acres of land annually, to say nothing of the trees utilized as lumber. While no one of note has disputed the influence of forests on rainfall, such influence has not been satisfactorily explained. The following explanation is offered :

The Gulf Stream projects its waters along the Atlantic coast. It furnishes moisture to the winds which sweep over the land,

tempering the climate. Formerly when these winds beat against the Adirondack highlands there were vast areas of brush-topped evergreens and myriad-leaved trees to act as electrical conductors and precipitate moisture in the form of rain. The forests have been ruthlessly cut and now the moist winds beat against the rocks and burst in floods of water or in form of hail, or sweep past with their possibilities of evenly distributed rain. Nature takes her swift vengeance. The river bottoms show at the surface and the hurricane and hailstorm beat down the structures made of the forests. As Mr. Colvin states in one of his reports, the forests hold snow in compact depths which melts slowly, contributing a regular quota of water during three-fourths of the year. The cones fall from the evergreens, become pulverized and overgrown with moss. These cone beds hold water to such an extent that they were named "hanging lakes." Wherever the forests have been denuded the snow banks and cone beds have disappeared and thus, concludes Mr. Colvin, nature has been robbed of her reservoirs.

It seems incomprehensible that so great a commonwealth as New York has appropriated so little to maintain a survey of its own valuable possessions. No foreign government expends such a pittance for surveys of bergs, as the Empire State has for its entire area. The necessities of war, for which we must prepare in times of peace, demand the most minute and exhaustive surveys. The exchange of real estate, the prevention of needless lawsuits among citizens, and the taxation system, demand accurate surveys. The lack of good topographical maps may yet cost a thousand times the amount required for engineering. Instead of five thousand dollars occasionally, the State should have appropriated seventy-five thousand annually for this purpose.

The growing demand that the Adirondack region shall be set aside as a public park with liberal appropriations for its protection, superintendence and surveys has been met with little legislative encouragement, which so far only amounted to successive and expensive commissions since 1873. There is not a prairie State to-day that would not give millions for one Mt. Marcy. New Yorkers have migrated to every portion of the Union in great numbers. Had they a voice in the matter, the Adirondack region no doubt would be surrendered to the United States and cared for as jealously as is the Yellowstone park, with full appropriations for surveys and maintenance. If the proper steps were taken, there is little doubt that the consensus of opinion of the people would be in favor of such transfer, since the State of New York has shown itself incapable of caring for its possessions.

EDITORS' TABLE.

EDITORS: A. S. PACKARD AND E. D. COPE.

— The relations of the National Academy of Sciences to the Government deserve the attention of the scientific men of the country. There are two views of the nature and functions of this body. One of these is, that it is the advisor of the Government in such matters as come within its scope. As it is most likely to be called upon for opinions in questions of applied science, it follows that a considerable number of its members should represent that kind of ability, rather than advanced positions in original research in pure science. The other view is, that the academy is a body which includes a definite number of men who lead the progress of pure science in the country, irrespective of utility to the Government, and that as such, its membership constitutes an order of merit which is the highest within reach of the American scientist. From this standpoint its relations to the Government flow simply from the character of its membership, and not from any especial modification of its organization.

There is no reason why the two propositions above stated may not both be realized in the academy. This is doubtless the opinion of the large majority of its members, and indeed represents the actual state of affairs in that body. It is, nevertheless, easily seen that however combined, the two ideas are themselves distinct, and that care will always have to be exercised to preserve a just equilibrium between them. The fact that a large proportion of its members are in the employ of Government bureaus can excite no adverse criticism, and is indeed a necessary consequence of the large number of experts required for the Government service. But the academy must be protected against possible consequences of this fact.

In the interval between the annual meetings of 1884 and 1885, two members of a committee appointed to investigate a question affecting one of the bureaus of which they themselves are employees, were requested to resign from the committee by the chief of the bureau in question. This was in obedience to the rule that a department of the Government cannot be criticised by its subordinates. It requires no argument to show that if this rule be carried out with reference to the Academy of Sciences its usefulness as an independent body is at an end. There is also

another danger which flows directly from the same or a similar attitude on the part of heads of bureaus. These gentlemen, by filling up the academy with their employees can obtain practical control of its decisions. This would be immensely convenient to them under various circumstances, but it would introduce an element of corruption into the academy from which it has been hitherto happily free, and which would deprive it of the respect and confidence of the country. So long as the bureaus remain under the direction of their present heads, such contingency is remote; but changes for various reasons, political or otherwise, are by no means impossible. It is easier to provide against possible evils than to reform them when they are upon us.

—— The papers read at the late meeting of the National Academy of Sciences include several of first-class importance in systematic analysis. Such is the paper of Mr. Scudder on the palæozoic insects, and such that of Dr. Sterry Hunt on the classification of the natural silicates. Of the same character was the paper of Professor Gill on the orders of fishes; and to the same class belongs that of Professor Cope on the phylogeny of the placental Mammalia. These memoirs, if published in extenso in the next volume of the memoirs of the National Academy, will give it a value commensurate with the place the society holds among those of the country. Of almost equal but less comprehensive importance were the three papers read by Professor Packard on Palæozoic Crustacea, and by Professor Cope on the Pretertiary Vertebrata of Brazil. The papers in other departments were less important than is sometimes the case at the meetings of the academy.

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RECENT LITERATURE.

Hand-book of Central European Forest Entomology.[1]—This promises to be a valuable contribution to forest entomology, especially as a text book in a school of forestry. This first part, now before us, is general in its nature, containing a brief biography of Ratzeburg, the leading authority on forest entomology, with a portrait; this is succeeded by chapters on the following subjects: The external form of adult insects; the internal structure of adult insects; reproduction and metamorphoses of insects; insects as natural and economic forces; the causes and remedies against destructive insects, and the economic compensations of the more extensive losses from the depredations of insects; general introduction to systematic and practical entomology.

[1] *Lehrbuch der Mitteleuropäischen Forstinsektenkunde, mit einem Anhange:* Die forstschädlichen Wirbelthiere. Als achte Auflage von Dr. J. T. C. Ratzeburg Die Walaverderber und ihre Feinde. In vollständiger Umarbeitung herausgegeben von Dr. J. F. Judeich und Dr. H. Nitsche. 1. Abtheilung, Ratzeburg's Leben, Einleitung, Allgemeiner Theil. Wien., E. Hölzel, 1885, 8vo., pp. 264.

The portion devoted in this work to the structure of insects seems to us too great, as there are good text-books on general entomology, but the physiological portions, especially those on the metamorphoses and reproduction of insects, are of immediate value to the practical observer. We miss full accounts with good illustration of the parasitic habits of ichneumons and Tachinæ. What is said of the influence of temperature, dampness and wind on insect life is valuable, as also the account of insect-destroying fungi, with the excellent cuts. While the work should give the student full theoretical knowledge it should emphasize all the facts leading to practical field work and observation.

CLAUS' ELEMENTARY TEXT-BOOK OF ZOOLOGY.—We have already called attention to the first part of this work, which has been translated by Sedgwick and Heathcote. The second part embraces mollusks, Tunicata and vertebrates, the spaces given to the last group being in our opinion too little; in such a book certainly one-half of the matter should be devoted to vertebrate animals. In point of treatment, and excellence of the illustrations the high character of the first part is well sustained in this the concluding part. The old meaningless group of Molluscoidea is, however, retained for the Bryozoa and Brachiopoda. To place these two groups of what may with safety be regarded as composite types of worms in a group equivalent in rank to the Arthropoda or Vertebrata shows lack of judgment. The author remarks in justification: "With the increase in our knowledge of their developmental history, it appears more and more probable, not only that the two groups are descended from an ancestral form common to them and the annelids, but also that in spite of the considerable differences between them in the adult state, they are in reality closely related, a supposition which agrees with the great resemblance of their larvæ."

The Tunicata are placed next to the vertebrates, above the mollusks and Molluscoidea, a position now seemed warranted.

The treatment of the Mammalia is, like that of the birds, antiquated, no reference being made to the new groups of extinct forms and the subsequent modifications which should be made in the classification of the class; besides, too little space is given to this most important of all classes of animals.

UPHAM'S FLORA OF MINNESOTA.[1]—The State of Minnesota is to be congratulated upon the appearance of so creditable a volume in its Annual Geological Report. The author has done a good work well and thoroughly, and has placed before the people of his State a work which will take rank as one of the best of its kind ever issued by the officers of a State survey. A good

[1] *Catalogue of the flora of Minnesota*, including its Phaenogamous and Vascular Cryptogamous plants, indigenous, naturalized and adventive. By WARREN UPHAM. Part VI of the annual report of progress [Geol. and Nat. Hist. Survey] for the year 1883. Minneapolis, Johnson, Smith & Harrison, 1884, pp. 193, with 1 plate.

map in colors shows the forest and prairie areas, and the distribution of the principal timber trees.

The total number of plants, including species and varieties enumerated in this catalogue is 1650, belonging to 557 genera and representing 118 natural orders. The series are distributed as follows:

Dicotyledons	1141
Monocotyledons	427
Gymnosperms	14
Pteridophytes	68

The catalogue is sent out as a report of progress, and the hope is expressed that it will incite all workers in the field to increased efforts. The final report is to include the lower groups of plants as well as the higher.—*Charles E. Bessey.*

RECENT BOOKS AND PAMPHLETS.

Forbes, S. A.—Description of new Illinois fishes. Ext. Bull. Ill. State Lab. Nat. Hist., Jan., 1885. From the author.

Packard, A. S.—On the embryology of *Limulus polyphemus.* III. Proc. Amer. Philosophical Soc., May, 1885. From the author.

Böckh, J.—Brachydiastematherium transilvanicum Bkh. et Maty. Ein neues Pachydermen aus den eocänen Schichten Siebenbürgens. Budapest, 1876. From the author.

Moseley, H. N.—Notes on the structure of Seriatopora, Pocillopora, Corallium and Tubipora. Ext. Quart. Jour. Mic. Soc., 1882.

——On the pharynx of an unknown Holothurian of the family Dendrochirotæ, in which the calcareous skeleton is remarkably developed. Ext. idem., 1884.

——On the presence of eyes in the shells of certain Chitonidæ, and on the structure of these organs. Ext. idem., 1884.

——Address to the biological section of the British Association, Montreal, 1884. All from the author.

Dawson, G. M.—On the superficial deposits and glaciation of the district in the vicinity of the Bow and Belly rivers. Ext. Rep. Geol. Surv. Canada, 1882–84. From the author.

Lydekker, R.—Catalogue of the fossil Mammalia in the British Museum. Part I. London, 1885. From the author.

Dollo, L.—Rhinoceros vivants et fossiles. L'origine des Mammiferes. Les Labyrinthodontes, etc. Ext. de la Revue des questions Scien., Jan., 1885.

——Première note sur le Simœdosaurien d'Erquelinnes. Ext. Bull. du Musée Royal de Belgique, 1884. Both from the author.

Gaudry, A.—Nouvelle galerie de Paléontologie. Mus. d'Histoire Nat., Paris, 1885.

——Nouvelle note sur les reptiles permiens. Both from the author.

Boehm, G.—Beiträge zur Kentniss der grauen Kalke in Venetien. Berlin, 1884. From the author

Mus. d'Hist. Nat. Paris—Rapports annuels de MM. les professeurs et chefs de service, 1882.

Lundgren, B.—Undersökningar ófver Brachiopoderna i Suerges Kritsystem. Ur Lunds Universitets Arsskrift, 1885. From the author.

Trouessart, E. L., et Megnin, M. P.—Monographie du genre Freyana Haller, et description des espèces nouvelles du musee d'Angers, 1885. From the authors.

——Les sarcoptides plumicoles ou analgésinés. 1re partie, Les Ptérolichés, Paris, 1885. From the authors.

Claus, C.—Elementary textbook of zoölogy. Translated by A. Sedgwick and F. G. Heathcote. 2 vols. New York, Macmillan & Co. From the publishers.

Terry, S. H.—Controlling sex in generation. New York, 1885. Fowler & Wells Co. From the publishers.

GENERAL NOTES.

GEOGRAPHY AND TRAVELS.[1]

AFRICA.—*Kilima-njaro.*—The account given by Mr. H. H. Johnston, before the Royal Geographical Society, of his stay at Kilima-njaro, adds more to our knowledge of the zoölogy and botany of the southern slopes of this great mountain than to its geography. The vegetation is luxuriant, trees ascend to nine or ten thousand feet, herbaceous vegetation is abundant up to 13,000 feet, and heaths and some shrubs linger to above 14,000 feet. The buffalo, koodoo and elephant appear to ascend even to the snow-line. Mr. Johnston saw the footprints of buffaloes at 14,000 feet, and came in sight of three elephants at 13,000 feet. A hyrax ascends to 11,000 feet. In the discussion which followed, Mr. Thomson described Kilima-njaro as an enormous mountain mass, some sixty miles long by thirty wide, upon the summit of which the great dome of Kibô and the peak of Kimawenzi were comparatively small excrescences. On the southern side the country of Chaga was formed of a series of terraces of fertile land, but on the northern side the mountain rose at an even angle from 3000 to 18,000 feet without a break by ridge or valley.

The Egyptian Sudan.—Colonel H. G. Prout, an American engineer, formerly under the employ of General Stone, has contributed to the *Engineering News* an account of the route from Suakin to Berber. This is of interest geographically from the light it throws upon the nature of the country, which from immediately behind Suakin to Wady Ariab, 118 miles from that place, is mountainous, the projected road passing, at about sixty miles from Suakin, through a defile 3000 feet above the sea. The map recently compiled from data furnished by the office of Naval Intelligence, shows this route, as well as those between Massowah and Kassala, and Korosko and Abn Ahmed. Gen. C. P. Stone contributes to *Science* an account of the climate of various parts of the vast region known as the Egyptian Sudan. From November to February inclusive, the province of Dongola is healthy, but in the spring months the heat is excessive, dust storms violent, and fever prevalent. The moist winds of early autumn increase the unhealthiness. At Suakin, the intense heat is the chief foe to health; but the province of Taka (capital, Kassala) and the district of Gallabat have, from June to October, a climate which is deadly to Europeans. At that season the rains are copious, and mingling with the floods of water coming down from the mountains of Abyssinia, cause the rich soil to become like a saturated sponge. Even the natives, in many districts, abandon the country from May to October, and reside in the desert.

[1] This department is edited by W. N. LOCKINGTON, Philadelphia.

ASIA.—*The Lower Helmund.*—The valley of the Helmund, at the point where it was struck by the Afghan boundary commission, below its junction with the Argandab, is narrow and limited by ranges of rolling clay or sandstone hills. Beyond these ridges rise other similar ridges, forming the *dashts*, or rolling plateaux of Southern Afghanistan. This desolate country is full of ruins. "From Lundi to Kala Fateh," writes Major Holdich, "one rides through and over the relics of dead kingdoms. The remains of forts, of deep-cut irrigation canals, of pretentious habitations which might have been palaces * * * are the common features of the landscape. Broken pottery strews the ground sometimes for miles at a time." All are built of mud or sun-dried bricks. During the whole of its lower course until it disappears in a hamun or swamp, it receives no tributaries. About Nadali are innumerable mounds, some of which, though always bearing ruins on their summit, are clearly stratified, and are therefore thought to be natural.

Discovery of the Sources of the Hoang-Ho.—The proceedings of the Royal Geographical Society for March contain translations of two letters sent by Col. Prejĕvalsky to the *Invalide Russe.* This intrepid traveler left Urga (a town in Northern Mongolia, situated on a branch of the Angora and south of the Irkutsk) on Nov. 8, 1883, and soon reached the vast desert of Gobi, which measures 2650 miles from east to west, and about 700 from north to south. The northern part of the desert is still a steppe region covered with excellent grass; but Central Gobi consists of perfectly bare flat spaces covered with pebbles and cut up at intervals by lone stratified ridges, while Southern Gobi is covered all over with quicksands, the remains of shoals and dunes of the once wide Central Asian sea. Terrible frosts in winter, without snow, and almost tropical heat in summer, with frequent storms, characterize this barren, rainless, riverless region; yet every part of it is inhabited by Mongols. Crossing the Khurkhu ridge, forming the eastern edge of the Altai, the southern desert, or Alashan, was entered, and a stay was made at Din-yuan-in, where the Alashan range runs like a wall between the desert and the cultivated banks of the northern bend of the Yellow river. Crossing the Nan-shan range, part of the unbroken wall which stretches from the Upper Hoang-ho to the Pamir, Col. Prejevalsky then entered Kan-su, and prepared to go in search of the hitherto undiscovered sources of the Hoang-ho. On his way he passed the plateau of Lake Koko-Nor, 10,800 feet above the sea; and then crossed the ridge of Burkhan-Buddha by a pass 15,700 feet above the sea. The circumference of Lake Koko-Nor is given as 166⅔ miles. Sixty-seven miles from the pass the sources of the Yellow river were reached. Two streamlets, flowing from the south and west, out of the mountains scattered about the plateau, unite at an elevation of 13,600 feet. The infant river is fed by the numerous springs

of the wide marshy valley (40 miles by 13½) of Odontala, or, as the Chinese call it, Sing-su-hai, or Starry sea. After a course of about fourteen miles, the river falls into a lake, the southern shores of which it colors with its muddy waters, then pouring out of it to the east it soon enters another lake, which it leaves a considerable river; further on, after making a sharp turn around the snow-covered ridge of Amne-machin, its mad current tears through the cross strata of the Kuen-lun and flows toward China proper. After this our traveler went southward, but was stopped by the unfordable Blue river, or Di-che (Yang-tsze), and returning northward, made his way to Zaidam, after two serious encounters with Tangutan robbers.

Asiatic Notes.—M. Donbrof has explored the upper course of the Selenka, and reached the hitherto unvisited source of this great tributary of Lake Baikal.——According to Mr. Gowland, who has recently crossed the central range of Corea during a journey from Sôul to Fusan, there are in this part of the peninsula no mountains above about 4000 feet in height, no characteristic volcanic cones, and no indications of mineral wealth. The resources of the country appear to lie entirely in agriculture.——M. Jos. Martin has arrived in Japan after a most arduous journey from the Lena to the Amoor, across the Stanovoi range of mountains.——Dr. Gustave Le Bon is traveling in Nepaul. He is said to be the first European who has been permitted to travel through that country.

AUSTRALASIA.—*The North Coast of New Guinea.*—Mr. Robidé van der Aa has recently published an account of two voyages to the north coast of New Guinea. In the first, the Mapia group of islands was visited, and the voyagers afterwards landed on Jamma, an island in Walckenaer bay, and a depot for the cocoanut fiber of the main land. About twenty-five miles south-east of Jamma is the mouth of a river, the Witriwaai, not found on any map. This was ascended to a large lagoon. About eight miles to the east is the Wiriwaai, with a strong current discoloring the water far out to sea. Sadipi bay, nearly a degree further east, is a deep and safe harbor. The houses here have at each gable end a pent-house roof, which comes so low that a hole is made to enable the occupants to crawl in. On the second voyage, the Amberno river was ascended for over sixty miles, when it shoaled, with a current of four and a half miles an hour. Mr. van der Aa argues from the size of this river (it is eight hundred yards wide) that it has a long course from the interior, cutting its way through the Rees mountains. Thus its upper waters may be navigable.——Dr. R. von Lendenfeld has found that Mount Kosciusko is not the highest of the Australian alps. He has ascended a higher peak at some distance farther south. This is 7256 feet high, while Mount Kosciusko has been measured at from 7171 to 7176

feet. The newly enthroned peak is named Mount Clarke. The upper limit of trees upon it is 5900 feet. Above 6500 feet patches of snow are found on the lee side of the main range, at 6500 feet.

AMERICA.—*Science* states that several expeditions to Alaska are projected during the coming season. Gen. Miles, who commands in the military district, desires to acquire a knowledge of Cook's inlet and the Tananah course and watershed, and it is hoped that a party under Lieut. Ray will be sent for the purpose. The party under Lieut. Abercrombie were unable to pass beyond the glacier alleged to obstruct the Copper or Atna river, about sixty miles from the sea. A party under Lieut. Allen left for the Copper river, June 30, and hope to cross the divide between that river and the Yukon basin and descend the latter. Lieut. Stoney is reported to have a new expedition nearly organized to continue his investigations of the Kowak river.

EUROPE.—M. Rabot has explored Lake Enara and the valleys of the Pasvig and Talom, in Finland. The country is an immense forest, with lakes and peat bogs scattered everywhere, and the only means of communication is by rivers which abound in cascades and rapids. Lake Enara, drained by the Pasvig, is a veritable inland sea, with hundreds of islets covered with magnificent pine trees. The country around it, level and little broken, forms a depression between the plateau of Finmark and the hills of Russian Lapland.

GEOLOGY AND PALÆONTOLOGY.

THE ORIGIN OF FRESH-WATER FAUNAS.—Professor W. J. Sollas gives to the world, in No. v, Vol. III, of the Scientific Transactions of the Royal Dublin Society a review of the causes which have originated and limited the fresh-water faunæ of the world. Three causes are admitted as proven: (1) the difference in chemical composition of the medium; (2) the severe character of the fresh-water climate; (3) the necessity for the suppression of a free larval existence. Although the first cause is doubtless a powerful one, it is not sufficient to alone account for the facts, as seems to have been too generally assumed, for in three months Beudant brought several species of marine mollusks to live in fresh water, and, though he failed with three species out of fifteen, it is probable that an unfailing supply of appropriate food and greater slowness in change of medium are the only conditions essential to the success of such experiments. Von Martens (*Ann. and Mag. Nat. History*, 1858) was the first to call attention to the climatic extremes suffered by animals resident in fresh water. Freezing limits them in the colder zones, while, though the populousness of the fresh waters increases towards the tropics, partial desiccation is a hindrance there. Yet, were the want of saltness

and the severity of the climate the only obstacles, we might expect that many more of the forms which crowd the coasts would work their way up the rivers. As a rule, however, the fresh-water forms are quite distinct from the marine, retain their distinctness everywhere, and, in time, are well marked as far back as the Mesozoic. It is therefore probable that the fact that the majority of marine invertebrata are diffused by means of free-swimming larvæ has been one of the chief obstacles to their spread up the rivers. These fragile and feeble larvæ always swim along with even an ocean current, and are utterly powerless to stem that of a river. Should a slow-moving marine animal succeed in ascending some distance up a stream, its larvæ, if free-moving, would infallibly be carried out to sea. By a detailed examination of the forms which inhabit fresh water, Professor Sollas shows that in most of them the free larval stages are suppressed. Other causes may exist. Thus the absence of suitable food is sufficient to account for the lack of carnivorous gastropods and cephalopods in the rivers.

Fresh-water animals may be converted into marine in three ways: (1) by direct migration; (2) by the conversion of the area they inhabit into a fresh-water basin or lake; (3) by adaptation to a terrestrial or marsh-loving habitat, and subsequent exchange of this for a fluviatile or lacustrine one. The first method can scarcely occur with fixed forms, unless they are parasitic upon locomotive animals. Some prawns and crabs appear to have thus immigrated by compliance with the three conditions, but the instances are very few. The wide changes in the distribution of land and water that have taken place in the course of geological time offer a more probable mode of the gradual transformation of a fauna from a marine to a fresh-water one. The comparative poverty of the latter may be due to the escape of some species, as well as to the extinction of others. The earliest lakes known are of the Devonian period, and one Devonian fossil at least, *Anodonta jukesii*, has been found. Helicidæ are found in the coal measures, and are probably the ancestors of the Limnæidæ. In the Lias and Oölite numerous fresh-water mollusks occur, and Cyrena, Neritina and Hydrobia probably date from the Trias. Several genera of fresh-water mollusks were already distributed over parts of the Palæarctic, Nearctic and Oriental regions in Cretaceous times. The Tertiary lakes of the northern hemisphere have suffered from a glacial era, and the Caspian has become unwholesome by concentration of its waters, yet it retains a relic of a Tertiary fauna; while the Central African lakes have a remarkable assemblage of Mollusca.

No marine mollusk is known to pass through a "glochidium" stage, like that of the Unionidæ; no marine Polyzoön or sponge produces statoblasts; no marine Phyllopod an ephippium; and no Tubularian an egg in a horny shell like that of Hydra. All

these are modifications suffered by fresh-water genera, are not shared by their marine relatives, and appear to be necessary to the existence of sedentary forms, as characteristic of fresh-water organisms. The wide distribution of a form introduced by floating timber is not probable until its developmental history has changed also.

THE BATRACHIA[1] OF THE PERMIAN BEDS OF BOHEMIA, AND THE LABYRINTHODONT FROM THE BIJORI GROUP (INDIA).[2]—In these contributions we find important additions by eminent palæontologists to the knowledge of the stegocephalous Batrachia of the regions named. In Dr. Fritsch's volume we have the continuation of an extensive work which we have noticed at various times in the NATURALIST as the successive parts appeared. We have to add, on this occasion, our renewed commendation of the care and detail with which Dr. Fritsch continues to develop the subject, and our praise for the admirable plates which accompany the text. The species treated of are those which belong to the larger forms of the Rhachitomi, together with some of the intermediate types, such as the Dendrerpetonidæ. Of the greatest interest are two new genera of the order Embolomeri, Chelydosaurus and Sphenosaurus, where the additional vertebral centrum, entire in the type of the order (Cricotus), is divided into three segments, two lateral and an inferior. This is a curious discovery, especially as Sphenosaurus has hitherto been regarded as a reptile.[3] It also has an important bearing on the value of the order Embolomeri, which Dr. Fritsch is disposed (p. 4) to question. He thinks that the embolomerous vertebral structure is confined to the caudal region in the genus Cricotus, although I have figured it in the lumbar and cervical region of that genus, and described it as found in the dorsal[4] region. Dr. Fritsch reached this conclusion because he finds that in Archegosaurus the caudal region is embolomerous, and the dorsal region rhachitomous. His discovery of the persistence of the embolomerous condition in the dorsal region of Chelydosaurus and Sphenosaurus might have suggested to him the correctness of my observations on Cricotus. I add here that in Eryops, in which the dorsal vertebræ are rhachitomous, the caudal vertebræ are not embolomerous. So Archegosaurus stands alone in this respect. This determination of the characters of Archegosaurus by Dr. Fritsch is very useful to American palæontologists, as it has hitherto been very imperfectly described. I have stated that there are vertebræ of this type

[1] Fauna der Gaskohle in d. Kalksteinen d. Permformation Böhmens. Von Dr. Anton Fritsch, B. II, Heft I; Praag, 1885.

[2] The Labyrinthodont from the Bijori group. By R. Lydekker, Mem. Geological Survey of India, Ser. IV, Vol. I, 1885.

[3] These two genera should form a second family of the Embolomeri, characterized as above, which I call the Sphenosauridæ.

[4] Proceedings Amer. Philosoph. Society, 1884, p. 29.

from Leybach in the museum of Princeton College, New Jersey. As they agree exactly with Dr. Fritsch's figures of Archegosaurus, it is difficult to perceive why he denies the accuracy of my statement in the matter (p. 15).

Both the authors here reviewed have evidently been more or less influenced by Mr. Miall's system of the Stegocephalous Batrachia—Dr. Fritsch adopting his names and Mr. Lydekker using his characters in defining his genera. We cannot but think that the publication of this system was a misfortune to the progress of the subject. The characters of the relative position of the eyes and nostrils and the outline of the skull are certainly only specific characters, and the veriest tyro in the study of recent Batrachia would not use them for generic characters, still less for family characters, as is done by Mr. Miall.

Dr. Lydekker's paper introduces an undoubted member of the order Rhachitomi to the Indian Permian fauna, and devotes his usual care to the description and illustration of it. Unfortunately the skull of the single specimen at his disposal has lost the bones of its superior face, so that many of the characters of the species and genus remain unknown. The latter, indeed, to which is given the barbarous name Gwandanosaurus, is not so defined as to be distinguishable from some of those already known. In view of its possibly turning out to be identical with some of these, Dr. Lydekker remarks that he relies on the spirit of the following rule of the International Geological Congress of Bologna "in favor of his own name," *i. e.*, "In future for specific names priority shall not be irrevocably acquired unless the species shall have been not only described but figured." This is a doctrine which if allowed, will be adopted very much on the principle of whose "ox is gored," and will work unfavorably at times against a good many names of Dr. Lydekker's A proper knowledge of the subject, and skill in systematic analysis, while never rendering illustrations unnecessary, are much more important than they to the real advancement of science.

Examples of the disregard of the law of priority in this paper are seen in the proposition that the name Actinodontidæ supersede Eryopidæ of prior date, and the use of the term hypocentrum for intercentrum of prior date. This we hold to be simply creating confusion, and causing much inconvenience to the student.[1] Moreover, Dr. Lydekker has not read the paper which he quotes. He states (p. 7) that the intercentrum of Cope is the pleurocentrum of Gaudry, and the centrum of Cope is the hypocentrum of Gaudry. The fact is the reverse. The intercentrum was renamed hypocentrum by Gaudry, and the centrum of Cope

[1] The same untenable method is evinced in Dr. Lydekker's rejection of the name Creodonta (1875), and the proposition to use in its stead the inconvenient expression "*Carnivora primigenia*" (Catalogue of Fossil Mammalia in British Museum, 1885, p. 20).

was called pleurocentrum by Gaudry. I have since adopted the latter term as a convenience, though this is not always true of the multiplication of names.—*E. D. Cope.*

THE GENERA OF THE DINOCERATA.—Professor Marsh's work on this order of mammals, just issued, supplies some important data as to the characters of some of the species described by him. I can now discriminate more clearly the generic characters, which are, I think, as follows :

Four bilobed symphyseal teeth on each side; inferior canine teeth not enlarged; inferior premolars three.................................*Loxolophodon* Cope.

Four symphyseal teeth on each side, at least some of which are not bilobed; inferior canine larger than incisors; four inferior premolars, the first and second separated by a diastema ....*Bathyopsis* Cope.

Four subequal (? bilobed) symphyseal teeth on each side; inferior premolars four (teste Marsh)......................................*Ditetrodon* Cope.

Two or three subequal symphyseal teeth on each side; three inferior premolars *Uintatherium* Leidy.

No inferior canines or incisors; three inferior premolars..........*Tetheopsis* Cope.

Most of the known species belong to Loxolophodon, each of the remaining four genera having but one species each. Loxolophodon includes as synonymes the names Dinoceras and Tinoceras Marsh, which were proposed as nomina nuda after Loxolophodon, and were not characterized until several years later. It is uncertain whether Eobasileus, which was proposed and defined at about the same time as Loxolophodon is distinct from it or not. Octotomus is also a synonyme. Ditetrodon is established on *Uintatherium segne* Marsh, and Tetheopsis on *Tinoceras stenops* Marsh.—*E. D. Cope.*

THE UNITED STATES GEOLOGICAL SURVEY.—In an article upon the organization and plan of the United States Geological Survey, published in the *American Journal of Science*, Mr. J. W. Powell states that, where the topography and geology are simple, as in the prairies and great plains, the sheets of the United States survey map are made on a scale of 1–250,000, or about four miles to the inch; while farther west, where both structure and topography are more complex, special districts are made to twice this scale, and important mining districts are drawn much larger. In the less densely populated portions of the eastern part of the United States, a scale of 1–125,000 is used, but the more densely populated portions are drawn to twice this scale, or about one mile to the inch. The whole of the United States and Alaska will, upon this plan, require not less than 2600 sheets; besides several hundred special maps. With the present organization, the map of the United States will be completed in about twenty-four years. About one-fifth of the United States (Alaska excluded) has hitherto been mapped.

INSECTS OF THE CARBONIFEROUS PERIOD.—The recent discoveries of Mr. Charles Brougniart in the insect fauna of Commen-

try, France, have thrown a flood of light over the obscurities of the Carboniferous epoch. Wings of a type which all writers had agreed were at any rate neuropterous, and referred to a special genus, Dictyoneura, are found by him attached to bodies which are clearly orthopterous, and of a specialized group, which one would scarcely have looked for in ancient times. Additional species now occur from time to time, and the number of forms referred to Dictyoneura is constantly growing. Others allied to them have been referred, and are still being referred, to other genera, and to still other divisions of Neuroptera.

Under these circumstances, and because a number of new American types need to be brought into their proper place, I have thought best to offer a brief synopsis of those Carboniferous forms heretofore discovered (with a few additional ones from this continent), which may be referred to the ancient Phasmida.

Among them will be found nearly all the species heretofore referred to the Termitina from the European coal measures, for a careful study shows that the white ants were not at all represented in Palæozoic times, so far as the forms yet discovered show. Most of those which have been considered Termitina belong rather here (they have already in several instances been referred here), while others belong to other groups of Neuroptera than Termitina.—*S. H. Scudder, in Proceeds. Amer. Acad. Arts and Sciences.*

Geological News.—*General.*—The Boletin Acad. Nac. de Ciencias de Cordoba contains two articles by L. Brackebusch upon the geology of the province of Jujuy. Except for the information gathered in 1876 by Lorentz and Hyeronimus, and some notes on the primordial fauna by E. Kayser, this northern part of the Argentine Republic has hitherto been geologically unknown. The south-eastern part of the province, near the Vermejo, is comparatively low, though even here the Sierra of St. Barbara rises west of the Rio S. Franciso to 3000 meters. The larger central and western portion is entirely a mountain land, range after range rising to heights of from 4500 to 5500 meters, separated by valleys, some of which are basin-like depressions, 30-60$^{km.}$ broad. This western part is sterile, while the east is highly fertile. The mountains of Jujuy have a closer relation to the Bolivian plateau than to the chains of the center and west of the Argentine provinces. The most western chains (Sierras de la Puna) consist principally of clay slates, alternating with grauwacke, and, save in one locality, are without fossils. The easterly Sierra de Chuni consists of slates, grauwacke and sandstones, the last rich in Silurian fossils, graptolites, trilobites, cephalopods and brachiopods. Newer formations occur in the basins between the mountains, gypsum-bearing sandstone, dolomite, limestone, oölite and bituminous shales, etc. Fish and insect remains have been found in the Sierra St. Barbara. Strata corresponding to those which

d'Orbigny referred to the triassic in Bolivia are by Brackebusch placed in the Wealden or Neocomian. In these Mesozoic strata occur many petroleum springs, and throughout Jujuy and Salta, in Bolivia, and probably below the diluvium of the Gran Chaco, the character of the formation is such that Brackebusch styles it the "petroliferous formation." A small basin near Jujuy has Post-tertiary strata, with beds of lignite and mastodon remains. Eruptive rocks occur in many localities, and gold ore is found in the beds of the streams which flow from the Sierra Cabalonga. ——Part 1 of the "Grand Atlas of the Second Geological Survey of Pennsylvania," with fifty sheets imperial folio, has been published at Harrisburg.——The two "Prix Vaillant" of the Academie des Sciences de Paris have been given, the first to M. Gustave Cotteau, for his researches among fossil echinoderms; the second to M. Emile Riviere for his work in prehistoric anthropology. M. Cotteau has published more than 1000 plates of echinoderms; and for thirty years has been known as a palæontologist. The results of the researches of M. Riviere have been published in a work entitled "L'antiquité de l'homme dans les Alpes Maritimes."——M. Dieulafait is now engaged in studying the deposits of iron, manganese and zinc which exist around the "Plateau central," in the Cevennes particularly. He arrives at the conclusion that these deposits are derived from the primordial rocks from which they were extracted by the action of sea water.——A. W. Waters has described more fossil cheilostomatous Polyzoa from South Australia. Of the 220 species now described in the series of papers, about half are still living. The species noticed in this paper are seventy-three in number. Attention was called to the fact that, though the shape and nature of the zoœcial avicularia are characters of the greatest value, yet their presence or absence cannot be made a specific distinction, as there are a large number of cases where specimens are found with none or only a few such avicularia, whereas on other specimens of the same species they may occur abundantly.

MINERALOGY AND PETROGRAPHY.[1]

PHYSICAL MINERALOGY.—*Cohesion.*—It has long been known that, aside from directions of minimum cohesion (true cleavage) in crystals there are certain planes in which a slipping of the molecules takes place with especial ease. These are called by the Germans "*Gleitflächen*," and to our knowledge of them a considerable series of papers by Mügge has largely contributed. This writer concludes that the "*Gleitflächen*" coincide with the cohesion maxima along which the molecules can be parted only with the greatest difficulty, while they may be made to slip or slide over each other as easily in this as in any other direction. The

[1] Edited by Dr. GEO. H. WILLIAMS, of the Johns Hopkins University, Baltimore, Md.

position of these planes was determined for gypsum, stibnite, bismuthinite, orpiment and cyanite,[1] and found to agree as regards their direction with what had earlier been observed in the case of mica, rocksalt, calcite and galena. Later, the application of Reusch's method of forming the so-called fracture figures ("*Schlagfiguren*") showed that the same was also true of erythrite, vivianite, hydrargillite, brucite, potassium ferrocyanide, uranium mica and even apophyllite and topaz. In the case of the two latter minerals, it was necessary to use a diamond-pointed instrument to make the impression.[2] Most interesting, however, are these "gleitflächen" in calcite, where they stand in the closest relation to the twinning planes. As "*structure planes*" Mügge designates all those along which slipping or a parting of the molecules can be readily effected. Of these in calcite R is the true cleavage plane ("Spaltungsfläche"); $-\frac{1}{2}R$ the slipping plane ("Gleitfläche"), while parallel to $\infty P2$ and $0R$ parting readily takes place under pressure in the proper direction ("Reissflächen"). If an artificial sliding of a portion of a calcite rhombohedron into twinning position parallel to $-\frac{1}{2}R$ be effected, the position of the R-faces remains unchanged; the $-\frac{1}{2}R$-faces, except the one in which the sliding took place, assume the position of $\infty P2$ planes, while these in turn come to occupy the place of $-\frac{1}{2}R$. A $0R$-face takes the position of $-2R$, parallel to which a parting has also been observed by Haidinger and Tschermak. Thus all the structure planes retain the same positions, although they exchange them among themselves. It is significant that all these planes, except $\infty P2$, which is a plane of symmetry, have been observed as twinning planes for calcite.[3] The great ease with which by slight pressure the molecules of calcite may be pushed into twinning position parallel $-\frac{1}{2}R$ suggests a similar origin for the lamellar twinning of many silicates, especially as this is often observed to be most developed where the pressure has been greatest. Van Werveke has called attention to this in the case of feldspar and diallage;[4] Bauer, in the case of cyanite.[5] Analogous examples seem to be Malacolite and salite ($\parallel 0P$), epidote and mica. [The present writer has recently observed that the apparently perfect cleavage of so much of the American sphene is conditioned by fine twinning lamellæ parallel to the face $-4P$ (Dana), which appear to belong to this same category, and may possibly have been produced by pressure. Hornblende rarely exhibits the same structure parallel to $0P$.][6] Mügge also describes twinning lamellæ in imbedded masses and crystals of hematite and corundum. They

[1] Neues Jahrbuch für Min., etc., 1883, II, p. 13.
[2] Ib., 1884, I, p. 50.
[3] Neues Jahrbuch für Min., etc., 1883, I, p. 32.
[4] Ib., 1883, II, p. 97.
[5] Zeitschrift der deutschen geol. Gesell., 1878, XXX, p. 320.
[6] Amer. Jour. of Science, June, 1885.

lie parallel to the face R, which plays here the same *rôle* as "Gleitungsfläche" as $-\frac{1}{2}R$ does in calcite. A similar structure is frequent in the Graves Mt. rutile parallel ∞P.[1] In these cases also, as with the silicates, the nature of the material prevented the artificial production of the lamellæ. In some minerals where no alteration of molecular arrangement could be brought about by pressure, this result was accomplished by heat. By a sufficient increase of temperature twinning lamellæ were seen to be developed in anhydrite,[2] cryolite[3] and leadhillite,[4] while thenardite was rendered optically uniaxial,[5] as Mallard had showed was the case with the corresponding potassium salt. (For the very interesting results of a similar nature obtained by Förstner on the feldspars of Pantellaria, see below.) W. Klein[6] contributes an interesting paper on the influence of heat on the optical properties of crystals, especially when this is applied unevenly to different portions of the section. Negative, uniaxial minerals, like apatite and calcite, show an opening of the interference figure into two hyperbolas, the line joining them being perpendicular to the direction in which the heat is applied. For positive crystals the same is observed, except that this direction is parallel to the line joining the hyperbolas. Biaxial crystals also exhibit similar phenomena, so that uneven heating may be regarded as a test of the character of double refraction similar to the use of the quarter undulation mica plate. The mineral, *heulandite*, is also made the subject of an extended investigation, the results of which cannot be here given. The *beaumontite* from Baltimore, commonly regarded as a variety of heulandite, shows such an entirely different optical behavior that the writer is inclined to agree with Rose in regarding it as a separate species.

J. Beckenkamp[7] describes a new and delicate apparatus for the measurement of the constants of elasticity in crystals. The results of numerous determinations are given whereby the conclusion is reached that the elasticity, like all the other physical properties of crystals, is in exact accord with the geometrical properties. The elasticity of alum was found to be less than that of any other known substance, which accounts for its anomalous double refraction, inasmuch as very slight pressure can produce a molecular disturbance. The elasticity of any crystal was found steadily to decrease with repeated compression.

R. Brauns[8] considers that the much discussed optical anomalies

[1] Neues Jahrbuch für Min., etc., 1884, I, 216.

[2] Ib., 1883, II, p. 258.

[3] Jahresbuch der Wissensch. Anstalten zu Hamburg, 1883, p. 67.

[4] Neues Jahrbuch für Min., etc., 1884, I, 63.

[5] Ib., 1884, II, p. I.

[6] Zeitschrift für Krystallographie, IX, 1884, pp. 38–72.

[7] Ib., X, 1885, 41–57.

[8] Neues Jahrbuch für Min., etc., 1885, I, 96–118.

of regular crystals are in many cases due to chemical impurity, especially the crystallizing together of isomorphous compounds. Alum, rocksalt, garnet and other substances are described. The same reason is assigned for uniaxial minerals exhibiting a biaxial character.

W. Voigt,[1] of Göttingen, has developed mathematically a theory to account for the peculiar interference figures exhibited by certain pleochroic (idiocyclophanic) crystals recently described by Bertin (*Zeitschr. f. Kryst.*, III, p. 449).

The Feldspars.—Professor Des Cloizeaux, of Paris, has just published at Tours a valuable memoir of ninety-two pages, entitled "Oligoclases et Andésine," being an enlargement of his former paper, " Nouvelles recherches sur les propriétés optiques des oligoclases," which appeared in 1880,[2] and a direct continuation of his still more recent studies on albite[3] (vid. Naturalist, 1884, p. 184). The latter paper describes thirty-four specimens from different localities, of which ten are American (Mineral Hill, Pa., Moriah, N. Y., Middletown, Ct., and Canada). In the present communication the number of oligoclase specimens examined has been increased from forty-four to sixty-six. These are divided into the following four classes:

1st. *Anomalous oligoclase or oligoclase-albite.*—The surface perpendicular to the plane of the optical axes truncates the *acute* edge P:M., making with P an angle of 93°. The extinction on M makes an angle of 6°–12° with the edge P:M, in a positive sense according to Schuster. Oxygen ratios vary between 1 : 3 : 10 and 1 : 3 : 10.7., corresponding to the mixtures. $Ab_8\ An_1$—$Ab_6\ An_1$.

2d. *Anomalous oligoclase.*—Plane of the optical axes is parallel to the basal pinacoid or perpendicular to the brachypinacoid. Extinction on M is positive, 6°–9° inclined to the edge P:M. Oxygen ratios vary from 1 : 3 : 10.4 to 1 : 3 : 9, corresponding to the mixtures $Ab_4\ An_1$—$Ab_2\ An_1$.

3d. *Normal oligoclase.*—Surface perpendicular to the opt. axial plane truncates the *obtuse* edge P:M, making with P an angle of 98°–104°. The extinction on M is positive, inclined 1°–6° (generally 2°–4°) to the edge P:M. Oxygen ratio is 1 : 3 : 9 := $Ab_2\ An_1$.

4th. *Andesine.*—Surface perpendicular to the plane of the optical axes truncates the *obtuse* edge P:M, making an angle of 110°–120° with P. The extinction on M is negative, varying from 1°–10°. Sp. Gr. = 2.67. Oxygen ratio 1 : 3: 8, corresponding to $Ab_1\ An_1$.

The first-class includes nine specimens examined, of which one is American (Colton, N. Y.). The second-class includes eleven

[1] Neues Jahrbuch für Min., etc., 1885, I, 119–141.

[2] Bull. Soc. Min. de France, 1880, III, 157.

[3] Ib., 1883, VI, 89–121.

specimens of which one is from Colton, N. Y., and one from Mineral Hill, Del. Co., Pa. The third-class includes sixteen specimens, mostly from Scandinavia, and the fourth-class nineteen specimens, of which one was from Château Richer in Canada. The remaining eleven specimens examined by the author did not yield altogether satisfactory results.

Very interesting facts regarding the relations between the monoclinic and triclinic feldspars have been obtained by Dr. Förstner of Strassburg, through his studies of material from the island of Pantellaria.[1] He finds that both the potash (orthoclase) molecule and the soda (albite) molecule undoubtedly possess a stable and unstable modification, the former being for orthoclase in the monoclinic, the latter in the triclinic system (microcline), while exactly the reverse is the case for albite. It has long been known that some varieties of orthoclase, especially sanidine, contain a very considerable amount of soda and the existence of the triclinic form of the potash molecule has been universally acknowledged since the classic investigations of Des Cloizeaux.[2] Förstner finds on Pantellaria that a monoclinic feldspar containing 2.1 albite molecules to every molecule or orthoclase occurs as a constituent of a certain rhyolite (Cala Porticello and Bagno dell' acqua). This he calls "Natronorthoclase." It is very similar both in composition and structure to that described by Brögger[3] and Mügge[4] from Norway, and by Klein,[5] from Hohen Hagen, near Göttingen. Even more common on Pantellaria, as a constituent of the augite andesite and pantellarite (a dacite characterized by a peculiar triclinic amphibole called "Cossyrite[6]") is a series of triclinic feldspars intermediate between albite and microcline. Very remarkable is the ease with which these intermediate members—natron-orthoclase and albite-microcline—can be transferred by artificial means from one modification to the other. Some albite-microcline (Cuddia Mida) shows, even by a temperature of 86°–115° C., a disappearance of its twinning lamellæ and by other optical changes is plainly seen to pass from the triclinic to the monoclinic system. The oligoclase-microcline from Mt. Gibele, on the other hand, remained unchanged even at 500° C. Most feldspars of this series changed back to their original triclinic form when the temperature was again reduced, except when it had been raised as high as 500°, in which case the change to the monoclinic form was as a rule permanent. The natron-orthoclase showed no change while being heated, but on being cooled from

[1] Zeitschrift für Krystallographie, VIII, 1883, pp. 125–202; IX, 1884, pp. 333–352.

[2] Comptes rendus, 1876, p. 885.

[3] Die silurischen Etagen 2 und 3 im Kristianiagebiet, etc.; Kristiania, 1882, pp. 258–262; 293–307.

[4] Neues Jahrbuch für Min., etc., 1881, II, 106.

[5] Göttinger Nachrichten, 1878.

[6] Zeitschrift für Krystallographie, V, 348.

a temperature of 264° C., it passed from the monoclinic to the triclinic modification, having a distinct system of twinning lamellæ and an inclined extinction of 2° against the cleavage lines on oP. The same feldspar was also found to undergo a like alteration when subjected to pressure, thus experimentally proving the suggestion of Van Werveke[1] that many plagioclase crystals owed their twinning striation to the pressure to which they had been subjected in rocks.

Hypersthene-basalt.—A correction should be made to the statement in the Petrographical Notes (Naturalist, April, 1885, p. 395), that Mr. J. S. Diller was the discoverer of the new rock type hypersthene-basalt. This rock was described by Messrs. Hague and Iddings in 1883,[2] in their Note on volcanoes of Northern California, Oregon and Washington Territory, and again in 1884[3], in their Notes on the volcanic rocks of the Great basin. It is, however, here spoken of as olivine-bearing hypersthene andesite, or as hypersthene-bearing basalt. These authors regard the hypersthene and olivine as playing complementary *rôles* in the lavas, *i. e.*, one being a singulosilicate and the other the corresponding bisilicate; in case a basalt grows slightly more acid the hypersthene replaces the olivine, which therefore diminishes in quantity as the other increases. In this way hypersthene-basalt may be regarded as a connecting link between basalt and hypersthene-andesite.

BOTANY.[4]

Fertilization of the Wild Onion (Allium cernuum).—The wild onion grows in masses along the banks of shady streams in August. The flowers are arranged in dense umbels, which are nodding as their specific name implies. They are of a beautiful rose color, presenting an attractive appearance, when seen from a distance. There are six stamens, which arrive at maturity one after the other, the outer row developing first (Fig. 1). In this

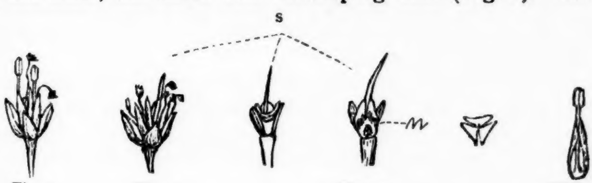


Fig. 1. Fig. 2. Fig. 3. Fig. 4.

Fig. 1. Antheriferous period. Fig. 2. Female state. Fig. 3. The three processes with nectaries (*n*) at their junction. Fig. 4. A stamen attached to an inner member of the perianth and enfolded by it.

successive development they resemble the usual course in the an-

[1] Neues Jahrbuch für Min., etc., 1883, II, p. 87.
[2] American Journal of Science, Sept., 1883, p. 233.
[3] Ib., June, 1884, p, 457 and p. 460.
[4] Edited by Professor Charles E. Bessey, Lincoln, Nebraska.

droecium of Umbelliferæ. The style remains small, maturing after the anthers have dehisced, presenting thus a case of simple proterandry. The last stamen has shed its pollen before the stigma matures (Fig. 2). Both stamens and pistils protrude considerably from the perianth, some of the anthers being empty while others in the same flower are immature or dehiscing. The stamens composing the outer row are partly enfolded by the inner set of the perianth to which they are attached at their base (Fig. 4). This tube serves as a guide to the nectary which lies just in front of the base of the inner set of the perianth. The nectary itself is a curious device, consisting of three organs placed so as to cover the ovary, being adnate to it, and bilobed above in such a manner that the contiguous lobes approach each other and serve as a cover to the three nectary glands just beneath their place of meeting. The nectary gland is thus enclosed by these processes of the ovary and the inner row of the perianth (which enfolds these processes or lobes, one sepal to each pair of lobes). The lobes afterwards appear as six teeth cresting the maturing ovary. Cross-fertilization is necessary in these plants and the office is undertaken by various sized bees. Self-fertilization apparently is impossible.—*Aug. F. Foerste, Granville, Ohio.*

THE CONTINUITY OF PROTOPLASM IN MANY-CELLED PLANTS.—A paper recently published in *Nature*, by Dr. Schaarschmidt, contains a summary of the results of investigations as to the continuity of protoplasm in the many-celled plants. From this it appears that the first direct observations were made by Theodore Hartig, in 1854, who described the continuity of the protoplasm in sieve tubes. This case of continuity confirmed by many observers remained the only one, until the year 1878, when Bornet and Wright published papers in which the communication between adjacent cells of the Florideæ was described. In 1879 or 1880, the communication between the endosperm cells of phanerogams was observed. Since that time numerous observations have been made, all tending to show that the phenomenon is far more general than at first suspected.

It has also been shown that protoplasm occurs in intercellular spaces; and now Dr. Schaarschmidt announces the discovery of inter-lamellar protoplasm, that is of a thin layer which occupies the position of what has been long known as the "middle lamella" of the cell wall

The "general results" are given by the author, as follows: (1) "The protoplasts of all the tissues in united cells are in direct connection by means of finely attenuated protoplasmic threads.

(2) "The connective threads traverse the pit-closing membrane (which is of a sieve-plate structure), while in unpitted cells they traverse directly the cell wall. By these threads is the communication between the connective process which occupy the pit-cavity from both sides directly established.

(3) "The intercellular plasm occurs not only in the intercellular spaces of the parenchymatic tissues, but also in those of true prosenchymatic tissues.

(4) "This intercullar plasm contains, in many cases, chlorophyll granules (in Viscum).

(5) "The intercellular plasm is in direct connection with the adjacent protoplasts.

(6) "Corresponding to the middle lamella around the cells, we find a plasmatic frame; the sides of this frame end in the 'intercellular plasma. This plasmatic frame forms a veritable mantle around the protoplasts, and it is increased at each edge by an intercellular plasm portion, which latter has a pillar form.

(7) "The connective threads of the protoplasts traverse this 'middle lamellary' plasma; both are also connected.

(8) The probable origin of this intercellular plasma is this: During the cell-division, when the division was almost ended, little cytoplasmic portions become included in the young cell wall, and it is also very probable that the connective threads, in many instances, are the remainder of the 'nuclear connective threads,' and that the middle-lamellary protoplasm is the remainder of the 'cell-plate.' All these plasma portions are by the thickened cell-wall much compressed together, and therefore only visible, or distinctly visible by the swelling of the cell-wall.

(9) "The intercellular plasm can cover itself with a cell-membrane, and in this way we find at the place of the intercellular spaces veritable new cells. About these new cells, appear later new secondary or tertiary intercellular spaces.

(10) "The protoplasm of the crystal-bearing cells (crystal glands), and that of the resin-canal cells is also in communication with the adjacent cells.

"The protoplasts of the plants (composed of tissues) form a higher unity, one synplast."

WILLKOMM'S ARRANGEMENT OF THE VEGETABLE KINGDOM.—In a review of a recently published "Bilder Atlas," by M. Willkomm, in the *Botanisches Centralblatt*, the following is given as his proposed arrangement of the vegetable kingdom:

FIRST KINGDOM. SPOROPHYTA.

Division I. Thallophyta.

Class I. Mycetoideæ, containing the orders 1. *Myxomycetes* and 2. *Fungi.*

Class II. Phycoideæ, containing the orders 3. *Lichenes*, and 4. *Algæ.*

Division II. Cormophyta.

Class III. Protonemaceæ, orders 5. *Hepaticæ* and 6. *Musci.*

Class IV. Prothallionatæ, orders 7. *Equisetinæ;* 8. *Lycopodinæ;* and 9. *Filicinæ.*

SECOND KINGDOM. SPERMATOPHYTA.

Division III. Gymnospermæ.

Class V. Pseudocarpæ, orders 10. *Cycadeæ;* 11. *Taxineæ;* 12. *Coniferæ;* and 13. *Ambiguæ.*

Division IV. Angiospermæ.

Class VI. Acotyledoneæ, order 14. *Rhizantheæ.*

Class VII. Monocotyledoneæ, orders 15. *Fluviales;* 16. *Spadicifloræ;* 17. *Principes;* 18. *Glumaceæ;* 19. *Enantioblastæ;* 20. *Helobiæ;* 21. *Gynandræ;* 22. *Scitamineæ;* 23. *Ensatæ;* 24. *Artorrhizæ;* 25. *Coronariæ.*

Class VIII. Dicotyledoneæ, orders 26 to 71, in approximately the sequence followed in Bentham and Hooker's Genera Plantarum. The "orders" here are, however, groups of higher rank than the "orders" of Bentham and Hooker, being in fact in many cases nearly synomymous with the "cohorts" of the authors last named.

The place assigned the Slime-molds (Myxomycetes) indicates the acceptance of what we have for many years considered to be the true interpretation of their structure and relationship. In like manner the treatment of the Gymnosperms indicates a more philosophical spirit and a practical recognition of the doctrine of evolution.

The Study of the Liverworts in North America.—As one of the results of the one-sidedness of the usual teaching of botany in this country, whereby it is almost entirely restricted to the flowering plants and "vascular cryptogams," we find a most unequal distribution of workers throughout the various botanical fields. We have any quantity of "phanerogamists," but though the cryptogamic fields bear a plenteous harvest, the laborers are few, and year by year as the scattered workers are cut off by death, there are few among the younger ones to take their places. There must be something faulty in the instruction given by our botanical teachers in the many colleges and universities in this country. The results would indicate that in too many cases the kingdom of plants is supposed to come to an end just a little way beyond the boundary of the phanerogams.

These thoughts are suggested by a little book recently brought out by Dr. L. M. Underwood, under the modest title of a Descriptive Catalogue of the North American Hepaticæ North of Mexico. In a prefatory note the author says, "The study of hepaticæ is attended with much difficulty for several reasons, among which may be named the following:

1. These plants are very largely neglected by collectors.
2. The literature on the subject is rare and inaccessible.
3. Most of our public and college libraries contain little or no literature upon this subject.
4. Many of the species described as new by American writers are not represented in any American collection.

It is to be hoped that the purpose of the book as stated by the author "to relieve in part these difficulties, and to stimulate a more complete collection of Hepaticæ" may be realized.

Turning to the body of the book we find a few pages devoted to the general characters of the liverworts, time of collecting, geographical distribution, essential characters, bibliography, etc., the remainder of the book being filled with the descriptive catalogue.

As to the time for collecting, the author says: "The hepatics should be collected for preservation and study when in fruit, if this be possible, and this condition occurs at different seasons in the various species; some bear fruit in late autumn, some in early spring, some in midsummer; in short, there is scarcely any season of the year, even winter, that will not find some form in fruit, yet the period from October to May may include the larger number of species for the cool temperate regions of America. Many species have never been found in fruit, and possibly never produce fruit, so it will be advisable to collect all species whether in fruit or not, for otherwise these less known forms may be neglected."

Comparing the systematic portion of this work with that of Sullivant, which was published in Gray's Manual, twenty-five years ago or thereabouts, we find a very considerable increase in the number of genera and species.

Orders of Hepaticæ.	*Genera.*		*Species.*	
	Sullivant.	Underwood.	Sullivant.	Underwood.
Ricciaceæ	2	3	8	24
Marchantiaceæ	8	13	12	22
Anthocerotaceæ	2	2	6	14
Jungermanniaceæ	26	32	82	169

An effort has been made to help the beginning by a judicious introduction of keys and synoptic characters, which from a personal trial we can assure the reader is fairly successful. The book ought to stimulate our younger botanists to take up the study of these plants, and we trust that the request of the author that collectors communicate specimens of the forms found in their localities may be abundantly rewarded.—*Charles E. Bessey.*

Botany at Salem.—The following extract from Professor Robinson's annual report of the work of the Peabody Academy of Science (the old home of the Naturalist) shows a commendable activity in its botanical department during the year 1884:

"In the department of botany a great improvement has been made. As various collections were from time to time arranged they have been placed in boxes in the dark spare-room on the lower floor of the museum. This year a suitable herbarium case of white wood, containing ninety-six compartments, has been placed in the lecture-room, in which all the Essex county collections and the general reference collection from North America have been arranged. Other collections have also been placed in the lecture-room, so that now the herbarium is in a dry and pleasant room where it can be easily referred to by those in charge of it and by students who desire to consult it.

"The academy now owns a very good collection of botanical reference books, and two microscopes, which, under proper restrictions, are placed at the disposal of any persons desiring to compare species at the museum. The herbarium is by far the best in the county; it is centrally and conveniently situated, and has

been frequently consulted through the year by students in this department of study. The special work on this collection has been the arrangement of the Algæ, of which there were a large number of specimens."

Botanical News.—For some time occasional papers have appeared in the *Amer. Mo. Micr. Jour.*, attempting to throw doubts upon the prevailing views as to the mode of fertilization in flowering plants. Microscopical preparations by Mr. J. Kruttschnitt, have been sent out for examination, with the intention of proving the new view. The editor of the *Botanical Gazette* in the January number devotes about a page to an indignant denunciation of the whole matter. In the January Jour. N. Y. Micr. Society, Dr. N. L. Britton devotes ten pages to criticisms of Mr. Kruttschnitt's papers and preparations. He closes by saying, "The fact of failure on the part of one, or indeed, of several persons, to discover a pollen tube in contact with the embryo-sac of an ovule, can, it seems to me, have no weight when viewed in connection with the fact that so many able investigators have often and undeniably seen such contact." The friends of this wild theory need no longer complain of its being ignored by botanists!——A. H. Curtiss, of Jacksonville, Florida, has prepared two series of wood specimens, including seventy-five species in each. Each specimen shows heartwood, sapwood and bark, and is accompanied by a printed label. The low price at which they are sold ($15 per single single series, or $25 for the two) ought to place them in many a botanical cabinet.——An important pamphlet On the establishment of a Botanical Garden and Arboretum in Montreal, has been issued recently by the Montreal Horticultural Society. It gives some valuable statistics as to the botanic gardens of the world, and sets forth their scientific and practical value. It is mainly from the pen of Professor Penhallow.——One of the most valuable catalogues issued by the exhibitors at the New Orleans Exposition is that enumerating the articles forwarded from the Island of Jamaica, the work of Mr. D. Morris. It is particularly interesting as containing classified lists of plants and plant products.——The collection of Florida woods in the exposition is one of the finest on exhibition. It was prepared, we are assured, by A. H. Curtiss, of Jacksonville.——The collection of California plants shown by J. G. Lemmon in the exposition, contains nearly a full set of the ferns of the Pacific coast.——One of the absurdities to be seen in the exposition is a large well painted sign over a section of a big tree *(Sequoia gigantea)* which gravely informs the seeker after wonderful things that these trees attain the age of 3700 years!——Strasburger's Kleine Botanische Practicum has just been received. It is to our mind a much more useful and usable book than the large one. It should be translated and republished at once in this country for the benefit of American students.——The thirty-fifth and thirty-sixth reports

PLATE XVIII.

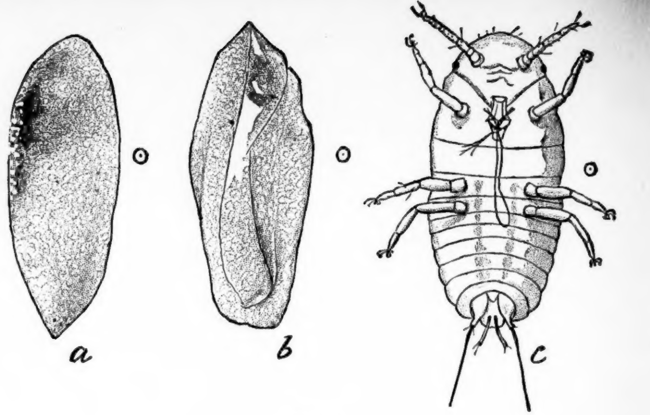


Fig. 1.

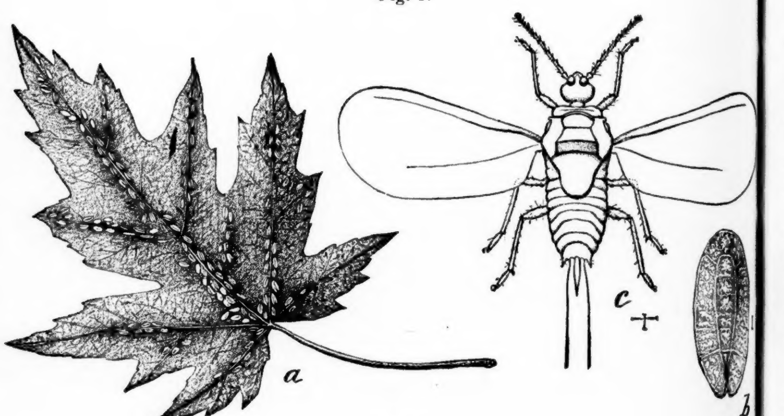


Fig. 2.

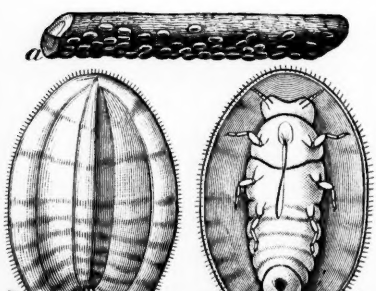


Fig. 3.

THE COTTONY MAPLE SCALE.

Fig. 4.

of the State Botanist of New York have come to hand. In the first, all the New York species of the sub-genus Lepiota of Agaricus, are described and systematically arranged, and in the second those of the subgenus Psalliota. Valuable notes and remarks upon various plants form a feature as heretofore of both reports, and quite a good number of new fungi are described. We only regret that it requires two years for these reports to go through the press.

ENTOMOLOGY.

Riley's Entomological Report for 1884.—The last report of the entomologist of the Department of Agriculture fills about 150 closely printed pages, with ten excellent plates and a full index. In practical as well as scientific value and in the variety of subjects treated, it is not inferior to its predecessors. The cabbage cut-worms are described at length and well illustrated, as well as a number of other insects destructive to this plant. Efforts have been made to introduce and colonize the European ichneumon parasite (*Apanteles glomeratus*) of the imported cabbage worm, and thus far the experiment has been successful.

The report contains also interesting life-histories of the American Cimbex, which has in Washington injured the willow, and lengthy notices are given of the Southern buffalo gnat, the angoumois grain moth, the cottony maple scale, the cranberry fruit worm, the larger wheat straw Isosoma, etc. Much attention is paid to the use of remedies.

The reports of the special agents comprise those of Mr. Hubbard on the rust of the orange, Professor Packard's on the causes of destruction of the evergreen trees of Northern New England and New York; Mr. Webster's on the insects affecting fall wheat; Mr. Smith's on those affecting the hop and cranberry; and Mr. Bruner's on the Rocky mountain locust, etc., in Nebraska. As a sample of the excellent illustrations is Pl. xviii, which represents the cottony maple scale, with its eggs and larva (Fig. 1), the leaf with male scales (Fig. 2), the female scales (Fig. 3), and in Fig. 4 the adult females with the wooly egg-mass as seen late in the spring.

Latzel's Myriopoda of Austro-Hungaria.—This admirable work bears all the marks of faithful and exhaustive labor, whether we consider the text or plates. The descriptions of the orders, suborders, families, genera as well as species are given in detail, especially those of the orders and genera, and the work will thus be of special value to American students.

This part contains monographs of the Symphyla, Pauropoda. and Diplopoda. Personally the reviewer does not regard the Symphyla, represented by Scolopendrella, as genuine myriopods, but none the less would he cordially welcome the work which

Latzel has bestowed upon them, especially his figures of the mouth-parts.

For the Chilognatha Latzel adopts the term Diplopoda of Blainville and Gervais; the latter term is a better one[1] if it has priority, as it is shorter and more expressive, but the author does not give his reasons for using it in preference to the commoner name. However, he regards the Chilognatha as the second suborder of Diplopoda, proposing two new suborders, first the Pselaphognatha (for the Polyxenidæ), and third and lastly the Colobognatha for the Polyzonidæ, all the other diplopods being placed under the Chilognatha.

The Lysiopetalidæ, as limited by American authors, is dismembered, all except Lysiopetalum being referred to the family Chordeumidæ, whereas he should regard the two groups as sub-families of Newport's group Lysiopetalinæ, established in 1844. The American genera Scoterpes, and Zygonopus are considered as identical, a view we at first entertained, but afterwards abandoned, so great is the difference in the sixth pair of legs and the male genital armature. Trichopetalum is regarded as identical with Craspedosoma and perhaps partly with Chordeuma.

Trouessart and Megnin's Sarcoptid Mites.—The first part of Trouessart's "Les sarcoptides plumicoles ou Analgésinés," embraces an account of Pterolichus and its allies, worked out with the aid of M. P. Megnin. These mites live on the plumage of birds, feeding upon the oily substance excreted by the skin, and not annoying the birds themselves; they are not then true parasites, but simply commensals. Several new genera and many new species are described, and the present part is illustrated by about twenty-five wood-cuts. About 150 species will be described. They have been taken from birds brought from different parts of the world, and it has been found that the same species of the subfamily lives on all species of birds belonging to one family. They are exposed to much variation, particularly *Fregana anatina*. The great variability of this species is readily explained by the parasite habits and by special condition of the medium, of food, habitat and climate. The work promises to be of much value to American students, for the subject here is almost unworked.

Entomological News.—The twelfth volume of the Transaction of the American Entomological Society opens with the second part of the late Dr. LeConte's Short studies of North American Coleoptera; and is followed by Dr. Horn's Study of some genera of Elateridæ; Mr. Williston's Notes on the North American Asilidæ (Part II); Mr. John B. Smith's Notes on the systematic position of some North American Lepidoptera, re-

[1] Die Myriopoden der Osterreichisch-Ungarischen Monarchie. Von Dr. Robert Latzel, Hälfte II. Die Symphylen, Paurodopen und Diplopoden. Wien, 1884. Alfred Hölder, 8vo., pp. 414, 16 Tafeln.

ferring especially to the Zygænidæ. It seems to us that Mr. Smith in this essay fails to take a comprehensive view of the group; his families are sub-groups, and to base families wholly on the venation is carrying matters to an extreme; the venation in this family seems to us to be mainly useful in defining genera. Mr. Smith is led to throw Endryas out of the family, whereas by its larval, pupal and head and trunk characters it is a true Zygænida, the characters Smith uses are, we think, superficial. The two closing articles of the first number of the volume are by Dr. Horn, on the North American species of Cryptobium and Studies among the Meloidæ.——Interesting notes on oviposition in Agrion and insect migration appear in the *Entomologists' Monthly Magazine* for February.——Mr. T. L. Casey's Contributions to the descriptive and systematic Coleopterology of North America contains carefully prepared and lengthy descriptions of new genera and species of American beetles which will be of permanent value. We trust that the time for sub-lined descriptions of Coleoptera has gone by.——At a meeting of the Entomological Society of London, held Feb. 4, Mr. W. L. Distant exhibited a series of wings of Indian butterflies, showing the differences between broods of the same insect in the wet and dry seasons respectively, which had hitherto been generally regarded as distinct species.——Professor Packard desires specimens of Nola and of the Notodontians, with a view to preparing a revision of these groups of Bombycidæ.——L. R. Meyer Dür, a well known Swiss entomologist, died at Zurich, March 2d, aged 73. On November 28th, G. A. Keferstein died at Erfurt, aged 91, at the time of his death the oldest entomologist in Europe.

ZOÖLOGY.

Distribution of Color in the Animal Kingdom.—L. Camerano discusses this subject at length. Colors may be arranged in accordance with the frequency of their occurrence, thus: (1) Brown; (2) black; (3) yellow, grey and white; (4) red; (5) green; (6) blue; (7) violet. Black, brown and grey are more common in Vertebrata than in Arthropoda, while red and yellow are more generally met with in the lower forms. Green is very frequent in the lower forms, less so in Mollusca and still more rare in Vertebrata. Violet and blue are the colors most seldom met with, but they occur in all groups of the animal kingdom. White is irregularly distributed, but more characteristic of aquatic animals. The colors of animals bear a relation to the mediums in which they live; parasites are less varied in color than free-living animals. Aquatic animals are commonly more evenly and less brilliantly colored than land animals; pelagic animals, as might be predicted from their transparency, are not strikingly colored. Among birds the strongest flyers are most soberly tinted. Of inhabitants of the sea, those that live among Algæ are more vividly

colored than those which live under stones or on a sandy bottom; similarly land animals that inhabit forests are on the whole more conspicuous for their bright coloration than animals which live in deserts. There is no relation between the color of an animal and its food, as Grant Allen has asserted; insectivorous animals that live among plants and flowers have often varied and brilliant colors; on the other hand, herbivorous animals, if they do not habitually live among shrubs and herbs, are dull and uniformly colored. The development of color stands in no relation to light, but depends far more upon the condition of the animal; ill-health and insufficient food causes a diminution in the brilliancy of its coloration.

In very dry climates the colors appear to be darker, while the reverse is the case in damp climates. The various zoölogical regions of the earth are characterized by a certain dominant range of color in their inhabitants; grey, white, yellow and black characterize the animals of the palæarctic region; yellow and brown those of the Ethiopian; green and red are the prevailing tints of the neotropical; red and yellow, of the Indian region. Australia is distinguished from the rest by the great abundance of black animals.

In a given group of animals the larger species are usually more uniformly colored than the smaller. Sexual colors bear a general correspondence to the development of the animal; the males are mostly more brilliantly colored; in many cases, however, where the females are larger and stronger than the males, the former show the more brilliant coloration. Young animals are often differently colored to the adults, their colors are generally more like those of the adult female. The young of several species that are most dissimiliar in their colors, when adult are often hardly distinguishable in this respect.—*Journal of the Royal Microscopical Society, February, 1885.*

LIFE-HISTORY OF STENTOR CÆRULEUS.—Professor G. W. Worcester gives a detailed description of the development and life-history of *Stentor cæruleus*, which can hardly be satisfactorily abstracted. When first observed it appeared a motionless, intensely blue mass, containing what seemed to be a row of internal vacuoles, which later proved to be the moniliform endoplast of the mature infusorian. A larger vacuole was observed that subsequently became the mouth. The mass slowly changed its form, developing cilia at each extremity. The cilia eventually disappeared from one end, the shape was constantly varied, and in a little less than two hours it had put on the mature form, and was swimming very rapidly. Conjugation with another specimen was then observed, each fastening itself by its posterior end to some object, their backs meeting, when they would roll over each other till their anterior extremities met. Conjugation lasted some moments when the specimens separated and swam away. The individual

observed lost its bluish tint and became of a bronze color. About an hour and a half after the conjugation it stopped suddenly, assumed a flat spread-out condition, whilst at the same time large vacuoles appeared throughout its entire mass. In appearance it was amœba-like, and after a time small masses became detached and immediately assumed a globular form. The detachment of masses whilst in this amœba-like stage in other specimens was witnessed, as also their development into mature forms.

The main mass would in some instances disintegrate after portions had been detached to form new individuals, nearly all the granular mass flowing out and leaving a row of egg-like bodies, the exact nature of which the author was unable to determine; he considers, however, that in them begins the cycle of life.

In one instance the specimen under observation only partially disintegrated, "the ciliated part, and a little more," remaining intact, and subsequently reforming into a perfect individual. Reproduction by the formation of internal embryos was also observed, likewise the rarer method of fission proper.

Professor Worcester considers the primitive form to be that of a sphere, and that the series of later forms assumed are so taken on by the creature in order to adapt itself more fully to its environment. The posterior end would seem to be appended more for locomotion and for the purpose of fixing itself. Conjugation must in some way play an important part in the re-arranging of the protoplasm.—*Journal of the Royal Microscopical Society, December, 1884.*

A Nervous System in Sponges.—Dr. R. v. Lendenfeld describes the presence of nervous elements and ganglion cells in the heterocœlous sponges. In the Sycones the walls of the pores contain groups of spindle-shaped cells, mesodermal in origin, which are frequently connected with branched cells, apparently of a ganglionic nature. In the Leucones sensory cells are present, but not concentrated round the pores. They are scattered here and there in groups over the general ectodermal surface; no ganglion cells like those of Sycones were discovered. In the Ascones the ordinary ectodermic cells appear to perform also the nervous functions. These results clearly show that the calcareous sponges at least can no longer be considered as Protozoa.—*Jour. Roy. Micr. Soc., April, 1885, 253.*

Shells of Bivalves.—An investigation of the structure and development of the shells of a great number of Lamellibranchiates has led W. Müller (*Zoöl. Anzeiger*, VIII, p. 70) to distinguish two chief varieties. First, in those shells which are only here and there connected with the mantle, the organic substance of the mother-of-pearl is membranous. Second, in shells which are continuously grown to the mantle, the organic substance of the mother-of-pearl layer forms a net-work. Only Cyclas represents

the second group, the former comprises all other Lamellibranchs.

The Lateral Line of Fishes.—It is familiarly known that the name of "lateral line" has been given by ichthyologists to an organ which runs along each side of almost all fishes, extending from the head to the tail. It has been successively studied by Steno, Lorenzini, Petit, Redi, Leydig and Schulze, the latter of whom have indicated the true path to be followed for the discovery of the functions of this line, whilst they have almost completed the investigation of its anatomy.

M. de Sède, in a thesis recently maintained before the Faculty of Sciences at Paris, and reproduced in Cosmos les Mondes, gave an account of certain interesting experiments made for the purpose of elucidating the physiological functions of this curious organ.

The fishes selected for the experiment were first submitted to the action of an anæsthetic, and then underwent the operation of re-section of the lateral nerve, which excited no reflex action due to pain. When resuscitated the subjects were left at rest in a large bowl, and some days afterwards they were placed in a vast aquarium where everything is so arranged that a fish desirous of circulating freely must make use of all its tactile resources and means of guidance. Under these conditions it was observed that the fishes which had been operated upon moved only with great caution, and were almost always the last to arrive at the distribution of food. Thus it appears that a fish able to make use of its eyes, but deprived of its lateral line, experiences a certain difficulty in finding its way.

M. G. de Sède next sought to ascertain how a fish would act if it retained the use of its lateral line, but was deprived of sight.

Two perches were blinded by removal of the eye-ball. There remained to them, then, for guidance, merely the general sensibility of the integuments and the special impressionability of the lateral apparatus in question. These organs acquire in a short time a great delicacy, for the two perches, when placed in the general aquarium, were soon able so guide themselves without any difficulty.

But the question now arises as to what part of this steering power belongs to the general sensibility, and what to this lateral line? Further experiments solved this problem.

A barbel was blinded, and, by way of extra precaution, its filaments were amputated. Subsequently its lateral nerve was severed. As long as this fish—even though deprived of its eyes and beard—retained the lateral nerve it guided itself easily; but as soon as this nerve was severed, it remained persistently motionless.

Lastly, a perch, blinded and deprived of its lateral line on one

side only, was placed in the labyrinthine aquarium. It contrived to keep the non-mutilated side turned towards any obstacle.

These experiments leave no doubt as to the function of the lateral line. It is a very delicate organ of touch, adapted to the requirements of an aquatic life. It is sensitive to the faintest movement of the water, takes cognizance of the slightest displacements, and gives fishes continual information on the state of the medium in which they live.

ZOOLOGICAL NEWS.—*Vermes.*—Mr. W. Bateson has contributed to the *Quart. Jour. Micros. Sci.*, an account of the early stages of the development of examples of Balanoglossus found at Hampton, Va. The adults agree very closely with *B. kowalevskii* of Agassiz, but as the development differs, the species cannot be identified. At no stage has the larva any superficial resemblance whatever to a Tornaria, such as is described by Agassiz as occurring in the development of *B. kowalevskii.* The eggs are elliptical and opaque, are fertilized outside of the body; divide into two, segment regularly and then form a hollow blastophore, enclosing a segmentation cavity. The gastrula is formed by invagination, the blastopore closes completely, a posterior transverse ring of cilia forms, and the body elongates and becomes marked out into regions. The mouth is a small pore in the ventral middle line of the anterior transverse groove; and the nervous system is formed by a segregation of epiblastic cells in the dorsal middle line of the collar, forming a cord lying immediately beneath the skin. The larva is always opaque, and creeps about in the muddy sand when hatched.

Cœlenterates.—According to R. von Lendenfeld, the *Crambessa mosaica* in Port Jackson is brown, while that of Port Philip is deep blue. The difference is caused by the presence of Zoanthellæ, parasitic algæ which may possibly be young stages of Laminarians, in the Sydney variety, which Mr. Lendenfeld names *Crambessa mosaica symbiotica*, because it has become associated symbiotically with an alga, and thus differs from the Melbourne form as lichens differ from fungi. Should the variety not be able to live without its parasite, it would be a new species. Huxley, in 1845, does not notice the brown color, and all previous authors, though they have collected the species near Sydney, describe it as varying in color from blue to gray. Our author asks whether the change has taken place since 1845?

Batrachians and Reptiles.—Professor E. D. Cope as one of the results of his studies on the batrachian and reptilian fauna of Mexico and Central America, which had been prosecuted by the use of material mainly placed at his disposal by the Smithsonian Institution, states that the total number of species described up to date is six hundred and ten, which is described as follows:

		Genera.	Species.	
Batrachia	Urodela	6	15	120
	Gymnophiona	4	7	
	Anura	31	98	
Reptilia	Crocodilia	2	3	489
	Testudinata	11	28	
	Lacertilia	42	184	
	Ophidia	92	274	

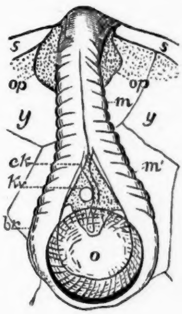
Mammals.—Dr. A. Günther (*Ann. and Mag. Nat. Hist.*, Dec., 1884), describes *Alcelaphus cokii*, a hartebeest, killed by Col. Coke, on the east coast of Africa, and *Gazella thomsoni*, from frontlets brought home by Mr. J. Thomson, from his recent trip to Mt. Kenia and Victoria Nyanza. Mr. Thomson also brought back a frontlet of *A. cokii*. Thomson's gazelle is marked with a distinct black lateral band, which is absent in the allied *G. grantii*, with which it does not mingle.——Mr. Caldwell writes that Platypus embryos are quite easy to get and he cannot understand why they were not obtained before. He has thirty blacks with him and they have found 500 Echidna in six weeks.——From a study of the cerebral convolutions of the Carnivora and Pinnepedia, Professor St. Geo. Mivart gives additional reasons for the threefold division of the forms into Cynoidea, Æluroidea and Arctoidea. In a paper recently read before the Linnean Society, he called attention to the universal tendency among the Arctoidea to the definition of a distinct and conspicuous lozenge-shaped patch of brain substance defined by the crucial and pre-crucial sulci. This condition does not occur in any non-Arctoid carnivore, but is found in *Otaria gillespii* and *Phoca vitulina*, where it is small and much hidden. He adduced this fact as an important argument in favor of the view that the Pinnipedia were evolved from some Arctoid, probably Ursine, form of land carnivore. The brains of Naudinia, Galidia, Crytoprocta, Bassaricyon, Mellivora, Galictis and Grisonia, were for the first time described in detail. The Viverrina, judged by the cerebral characters, formed a very distinct group among the Æluroids.

EMBRYOLOGY.[1]

On the Formation of the Embryonic Axis of the Teleostean Embryo by the Concrescence of the Rim of the Blastoderm.—During the season of 1881, I had an opportunity to study part of the developmental history of *Elacate canadus* at Cherrystone, Virginia. But unfortunately the lot of ova investigated by me did not develop to the period of hatching, but only passed a little beyond the stage when the blastoderm closes. As I have referred elsewhere to the very remarkable condition of affairs observed by me just previous to the closure of the blastoderm in this species, and not being likely to soon again have an opportunity to study the same form, I will now describe and figure what

[1] Edited by John A. Ryder, Smithsonian Institution, Washington, D. C.

was then observed in a number of ova, from which I infer that the peculiarity about to be described is charactistic of the development of this form. This species hatches in 24 to 36 hours.



The accompanying figure represents the embryo lying on the surface of the vitellus, and is represented as foreshortened, anteriorly the optic lobes, *op op*, on the other side of the vitellus show through the transparent yolk. The embryonic axis shows the segments or somites, *m*, distinctly developed, but it is very remarkable that the segmentation does not end at the point where the axis of the embryo so far formed ends. The right and left limbs of the blastodermic rim form a λ-shaped mass, together with the embryonic axis anteriorly, but unlike any other normal teleostean embryo both these limbs of the rim are distinctly segmented for some distance as at *m'*.

Just within the yolk and a little in front of the yolk-blastopore, which runs forward into the acute angle formed by the limbs of the blastodermic rim, *br*, lies the large oil drop, *o*. A lozenge-shaped mass of cells lies in the acute angle of the λ-shaped terminal part of the embryo, which appears to contain or overlie Kupffer's vesicle, *Kv*, and what was assumed to be the chorda, *ck*, at the time the observation was made, but of the certainty of this determination I am not at present satisfied. I was enabled to sketch this and a slightly more advanced stage several times, and as already stated found the same condition in a number of embryos, which seemed to be developing normally. Four other sketches show that the blastoderm finally closes very much as in other teleostean embryos and that pronounced wrinkles radiate from the crater-like opening upon the yolk where the yolk-blastopore finally disappears.

The conclusions of His and Rauber to the effect that the embryonic axis is formed by the gradual fusion from before backwards of the inner edges or the lips of the yolk-blastopore, as it advances over the surface of the vitelline globe, are in this case evidently correct, though it must be admitted that the presence of the cellular mass between the limbs of the blastodermic rim where they join the embryonic axis is not a little puzzling.—*John A. Ryder.*

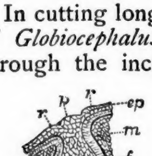
The mode of Formation and the Morphological value of the Egg of Nepa and Notonecta.—In the last number of the *Zeitschr. für wissenschaftl. Zoölogie*, 1885, xli. (p. 311), Ludwig Will has an article on this subject and reaches the rather startling conclusion that an egg-cell is not necessarily a simple protoplast, but may, while on the way towards the development of the ripe

egg, give rise to other cells In fact, the central chromatin body of the primitive egg-cell, which he calls the *oöblast*, ejects a large number of chromatin pellets from its substance which become the nuclei of the cells forming the egg-follicle. The conclusion at which Will arrives after reviewing the work of Fol, Roule, Sabatier, H. Ludwig, Balbiani and others, that in the ascidians, myriapods and insects, the nuclei of the follicular epithelium owe their origin to the primitive germinal nucleus or the oöblast, also holds good in respect to the ova of birds and amphibians, is of great interest, and stands in sharp contrast to the old view that, the ovi-cell and epithelial cells of the follicle were both originally similar elements (germ-cells), but which have merely developed farther in widely differents ways.

Will summarizes his results as follows: 1. The nuclei of the follicular epithelium are formed from the oöblast. 2. The residuum of the oöblast becomes the germinative vesicle of the egg. 3. Ova which are without a follicular epithelial investment, as is the case in numerous groups of animals, are homologous only with the egg plus the follicular epithelium of the higher forms. 4. The egg of the Hemiptera is neither a cell nor an assemblage of cells, but the *product* of several cells. 5. The homological value of the eggs of different types is to be found in the fact that, in every case the ripe egg represents a germinal mass, in which are contained all the capabilities of future development, and which is the *product* of the activities of those cells which have shared in its construction.

On the Development of the Mammary Glands of Cetacea.—The following is an abstract of an account of some researches just completed for publication upon this subject, founded upon materials in the U. S. National Museum.

In cutting longitudinal sections of the tail of a female embryo of *Globiocephalus melas*, two inches long, the microtome cut through the incipient mammary glands, one of which lies on either side of the external genital opening. The direction of the plane of section is nearly vertical and transverse judging from the appearance of the consecutive series. The accompanying cut will give the reader some idea of the appearance of these organs at the time they begin to be involuted or formed as thickenings of the epidermis of the young fœtus of these huge mammalia.



The outer corneous layer of the epidermis or epiblast, *ep*, and the lower layer of the latter on the Malpighian stratum, *ep'*, are alone concerned in the formation of the first rudiments of the mammæ, as in other mammalia. Although but a single stage was investigated, and not being aware of the existence of any previously published researches upon this subject, it has been thought best

to give my results together with such other information as could be gathered from the examination externally of the mammæ of a female whale's fœtus, five and a-half inches long, belonging to the Pacific genus Rhachianectes. The stage here figured displays the gland in the undifferentiated condition of the five-months' human embryo, when the gland consists merely of an involution of the malpighian layer, *ep'*, filled by a solid core of more rounded cells, *f*, which seem to become blended, at the lower end of the involution, with the Malpighian layer, the whole structure presenting the appearance of a solid pyriform body jutting down into the mesoblast, *m*, and connected with the epidermis externally by a narrow pedicel.

No signs of the outgrowth of the rudiments of acini from this pyriform body have yet appeared, but it would be inferred from the shape of the gland in the adults that these acini would be most apt to first appear at the anterior and posterior sides of this body. The gland in the adult cetaceans is greatly elongated, flat and less than one-third as wide as long, reaching the enormous dimensions of ten feet in length, three feet in width and eight inches in thickness in the adult, gravid female of *Balaenoptera sibbaldii.* In the adult the gland is also traversed longitudinally by a spacious lacteal sinus, which is probably developed during the growth of the gland by a process of vacuolization. This sinus opens externally through the nipple by way of a single duct. The gland therefore probably belongs to that subdivision of mammary organs provided with pseudo-nipples, which are developed by the production of the edge of the embryonic mammary area into a tubular teat traversed by a single canal as in the cow, certain marsupials and rodents.

In combination with the peculiar internal structure of the mammary gland of cetaceans, there is also an external teleological modification of a remarkable character, the nipple itself being lodged in a cleft or fossa, and concealed from view from without by a pair of longitudinal folds which close over it. From the evidence presented by my sections of the stage here figured of the development of the mammæ of Globiocephalus, when compared with the condition of these organs in the relatively older female embryo of Rhachianectes, already mentioned, it would seem probable that these folds were developed very early, as the nipple-rudiment or mammary area, *p*, has a fold on either side of it, represented in the figure by the elevations, *r r*, because in the larger embryo of Rhachiancetes the mammary fossæ are already developed, and there are no externally visible indications of nipples under or between the folds, the cleft being still very short in this specimen, or only about 0.5 millimeter, being absolutely minute as compared with the mammary fossæ of the adult, in which they must be over a foot in length.

It thus becomes evident that the mammary glands of cetaceans

develop at the start in much the same way as those of other Mammalia, but that their evolution is complicated somewhat by the early appearance of the folds on either side of the mammary area, which grow upward to form the sides and roof of the fossæ, which eventually enclose the nipples. The condition of the still earlier stages of the gland, judging from the general appearance of my sections, must be very similar to that observed in other mammals by Huss, Langer, Kölliker and others.—*John A. Ryder.*

PHYSIOLOGY.[1]

BACTERIA LITERATURE.—Bacteria, by G. M. Sternberg, M.D. Wm. Wood & Co., N. Y., 1885; Micro-organisms and Disease by E. Klein, M.D., F.R.S., Macmillan & Co., 1884. English-reading students are to be congratulated that two such competent workers as are the authors of these books have not only given accounts of our knowledge concerning bacteria, but have described in sufficient detail their experimental methods so that the laboratory student has but to follow directions in order to enter the field of bacteria research.

Dr. Sternberg's work includes a translation of Megnin's Bacteria, in which are described the morphology, classification and physiology of the germ fungi. But the laboratory student will find particularly valuable the translator's original chapters on technology, germicides and antiseptics, bacteria in infectious diseases and bacteria in surgical lesions. Photo-micrographs form in part the illustrations of the book. To a worker the bibliography alone is more than worth the price of the book.

Photo-micrographs and how to make them, by the same author, is an elaborate and practical aid in this special branch of technology.

The work of Dr. Klein is a reprint of a series of articles which appeared first in the *Practitioner*. In addition to a clear account of methods of research the author gives a copiously illustrated description of the forms of bacteria and a consideration of their relation to disease. Especially valuable are the criticisms on such views as Buchner's concerning the transmutability of pathogenic and non-pathogenic forms.

VASO-MOTOR NERVES.—Recherches Experimentales sur le Système Nerveux Vaso-moteur, Paris, Masson, 1884, pp. 338. Under this title MM. Dastre and Morat collect and publish with considerable diffuseness the results of observations on the functions of the vaso-motor nerves already announced by them during the last five years.

This work does not strike the reader as a very keen criticism of disputed points in this difficult subject, nor is any considerable experimental ingenuity manifested. The method of exposition,

[1] This department is edited by Professor HENRY SEWALL, of Ann Arbor, Mich.

however, is admirable and the historical introductions might have been made of much value had the same attention been paid to the literature of other nations as has been given to that of the French. The authors study separately: 1. The innervation of the cutaneous blood-vessels. 2. The dilator-function of the grand-sympathetic. 3. The vaso-dilator nerves of the external ear. 4. The vaso-dilator nerves of the inferior limbs. 5. Influence of the blood of asphyxia on the nervous mechanism of the circulation. The authors are convinced that the slow rhythmic contractions which small arteries, as those of the rabbit's ear can be seen to undergo are not peristaltic, proceeding from the heart outwards, but involve the whole vessel simultaneously. In nearly all nerve trunks containing vaso-motor fibers, as the sciatic, the cutaneous and the sympathetic nerves, the vaso-motor filaments are of two kinds, vaso-dilator and vaso-constrictor. Efferent or centrifugal vaso-motor impulses, like ordinary motor discharges, all leave the spinal cord by way of the anterior spinal nerve roots; on the other hand all afferent or centripetal vaso-motor impulses enter the spinal cord through the posterior spinal nerve roots. The chemical condition of the blood determines largely the vaso-motor coördination between the vessels of the skin and of the viscera; asphyxia produces a dilatation of the vessels of the skin and a simultaneous contraction of those of the viscera. The direct action of dilator nerves traveling in the sympathetic can be demonstrated on the dog; stimulation of the sympathetic nerve in the neck causes flushing of the mouth and face on that side.

The most valuable part of the work is that which considers the vaso-motor functions of the sympathetic ganglia. The observations indicate that these ganglia are automatic vaso-motor centers from which impulses go out to the muscular coats of the vessels and keep them in a state of tonic contraction. Dilation or, on the contrary, stronger contraction of the vessels is brought about indirectly by either stimulation or inhibition of the activity of the appropriate sympathetic ganglia through impulses reaching these ganglia from the spinal cord along either vaso-constrictor or vaso-dilator spinal nerves. The physiological classification of nerves announced by Borden and by Bichat is still supported by fact; namely, that the cerebro-spinal system presides over the functions of animal life and of relation; while the sympathetic system is concerned with the nutrition and vegetative life of the body.

THE PHYSIOLOGICAL PURPOSE OF TURNING THE INCUBATING HEN'S EGG.—The setting fowl frequently turns her eggs during incubation and when this process is carried on artifically, mechanical means must be adopted to effect the same purpose. M. Dareste finds that during the first week of artificial incubation eggs which are turned develop in essentially the same manner as those which are allowed to rest, but the monstrosities which have already been

formed in the latter soon take on an excessive development and in very few eggs which are allowed to remain unmoved during the whole period of incubation does the body cavity of the embryo become closed in. The cause of death in the unmoved eggs is, according to Dareste, the union by growth of the allantois with the egg-yolk which latter is thus prevented from becoming finally absorbed into the alimentary canal preliminary to the closure of the body cavity. These adhesions of the allantois with the vitelline membrane lead to frequent rupture of the latter whose contents are thus largely lost to the embryo. Death of the chick in the unturned eggs usually occurs about the second week of incubation. When the eggs are turned over it is probable that the position of the allantois upon the yolk is shifted and this daily movement prevents adhesion between the two surfaces. Sixteen eggs were placed under the same conditions of artificial incubation, but eight were allowed to remain unmoved while the eight remaining were turned over twice a day. In the first set absorption of the yolk did not occur in any specimen, and all the embryos died in the course of the second or third week. In the second set, in six eggs the yolk was absorbed in the normal manner; in a seventh, opened on the twenty-second day, the chick was alive and hearty and the yolk was being absorbed; in the eighth egg the chick was dead on the twentieth day and adhesion between the allantois and yolk had prevented absorption of the latter.—*Comptes Rendus, 1884, p. 813.*

PSYCHOLOGY.

Psychical Research.—At the Birmingham Midland Institute in November last, Mr. W. H. Myers, M.A., gave a lecture on "Aims and Methods of Psychical Research." The lecturer began by dwelling on the difficulty which the religious and scientific world experience in finding a common ground on which to meet, and pointed out that neither party had made a serious attempt to test the real value of those scattered indications of a psychical element in man which actual experience offers us. He explained that the object of the Society for Psychical Research was to subject all these indications to a fair and unbiased examination on scientific lines. The experiments which had so far been tried consisted mainly in discovering persons of special sensitiveness, and subjecting them to certain influences, either of magnets, &c. (as in the experiments of Reichenbach, of Charcot), or hypnotic or mesmeric passes, or of mere expectant attention, this last possibly inducing some influence at present unknown, as in so-called spiritualistic séances. In the lecturer's view it was at present wholly premature to ascribe the last phenomena to the spirits of the dead. Whatever in them was not due to mere fraud, must wait for an explanation until the simpler phenomena connected with sensitives were much better understood. The lecturer then

explained the important discovery (due mainly to the society's experiments, and to those of Professor Barrett in the first place) that mental pictures, thoughts, and sensations can in some cases be transferred from one person to another without contact, and without the agency of any of the recognized organs of sense. Some diagrams were here exhibited, representing simple outline drawings, which had been drawn by one person and reproduced by another person who had not seen them, but into whose mind their image had apparently been projected by a strong concentration of thought. It was next shown that this theory of thought transference could be extended so as to explain many cases of apparitions at death, &c., of which some examples were given. The lecturer insisted on the importance of a very large collection, and a very careful sifting, of first hand narratives of apparitions, premonitions, &c., with a view of discovering the laws which govern such occurrences. The risks of error or exaggeration in these accounts were pointed out, and a warning was given against premature theorizing. The audience were requested to send to the secretary of the Society for Psychical Research, 14 Dean's-yard, Westminster, any well-attested narratives of apparitions, &c., which they could collect, and especially the records of any experiments in thought-transference, &c. The lecturer concluded by stating that, although the evidence hitherto collected could not be said to amount to a proof of the survival of the soul after the death of the body, yet, so far as it went, it pointed in that direction. The evidence of the materialist theory was simply negative. That theory might be likened to a pyramid set on its apex: it was in a state of unstable equilibrium, and the smallest amount of positive evidence against it was sufficient to overturn it as a scientific theory. He drew a picture of the probable effect on human life and character if that great hope were to be raised into scientific certainty, and to become a pervading and dominant belief. Towards such great issues psychical research seemed to be tending, though the work must be minute and laborious, and the result must be slowly won.—*English Mechanic.*

A DOG ASHAMED OF THEFT.—A Baltimore gentleman owns a skye terrier which recently proved that it could feel ashamed of a dishonest act. At the time in question the gentleman was seated at his table. The little Skye saw a cutlet near the edge of the board, and yielded to the temptation to steal the meat. The cutlet was slyly seized and taken under the sofa. The gentleman pretended not to see the act of theft. But the conscience of the little terrier soon got the better of its hunger. It brought the cutlet back, laid it the feet of its master, hung its head in shame and slunk away.—*Philadelphia Call.*

We never personally knew "old Rove" to steal, but we were informed that he did once steal a piece of corned beef from a

grocer in town. At home he never took a thing without asking for it, though legs of mutton have hung for days and days within his reach. But unfortunately we cannot say as much for "Floss," who however, will at once surrender anything taken, upon command; but we don't think that he *looks* as ashamed of the act as he ought to. He is no thief, however.

We have not a doubt that early and persistent training of a bright dog, commencing with him when only a few weeks old, would cultivate the moral side of his nature, as his intellectual side is trained and developed by his intercourse with man. But beating never brings about any such results.

The other evening we had turned "Floss" out into the barn, and when he returned through the well room we have no doubt he gave us notice he wished for water; but we did not observe it. As we passed into the kitchen we turned to close the door after the dog, and there he stood upon the threshold, with such a look of intense yearning coupled with astonishment on his face, that we at once recognized his demand and supplied him with water. We thought that if there was not soul behind that look, the Creator of us all had surpassed Himself in lighting up the cold clay with the light of life. We don't say it can't be done, but we do not believe it *is* done.—*Brunswick Telegraph.*

ANTHROPOLOGY.[1]

Anthropology at the New Orleans Exposition.—Every allusion to anthropology in New Orleans should begin with Dr. Joseph Jones, author of the Smithsonian contribution entitled the Stone graves of Tennessee. Since writing this contribution Dr. Jones has utilized his leisure from an arduous profession to continue his researches in American archæology and in the various living problems which his position of president of the Board of Health brought before him. His splendid cabinet occupies one entire side of his house and contains nothing but the *chef d'oeuvres* of American aboriginal art. Dr. Jones has in his possession a relic which will interest active archæologists. At Selzertown, fourteen miles from Nachez, is a celebrated mound mentioned by Squier and Davis, covering about five acres of ground and about fifty feet high.

The top of the mound is truncated and the sides indicate that the structure was formerly a regular teocalli erection. Into this Dr. Jones drove a trench twenty feet horizontally and fifteen feet deep, coming upon cedar posts and charcoal mixed with ashes. Beneath these ashes was discovered a fragment of a French burr millstone weighing about eight pounds. Dr. Jones has preserved this fragment as an evidence of the late day at which the Nachez Indians erected their pyramidal mounds.

[1] Edited by Prof. Otis T. Mason, National Museum, Washington, D. C.

Abbe Roquet, in the Bishop's palace, is an excellent Choctaw scholar, speaking the language fluently. He is collecting material for a grammar and dictionary of that language.

In the New Orleans exposition almost every State and foreign government has exhibited something of the greatest interest to the anthropologist. From Maine we have basket and bark work of the Quoddy Indians. From Ohio, Indiana, Illinois, Missouri, Arkansas, Tennessee, North Carolina and a few other States there are very instructive private collections of antiquities. Louisiana exhibits one screen of the blow-tubes, basketry, bows and arrows and clothing of the Shetimasha Indians. Minnesota has a very large exhibit of sledges, birch bark work and Indian clothing. Nebraska, Dakota, Montana, Wyoming, New Mexico, Arizona, Nevada and California all exhibit the weapons, dress and implements of their modern tribes. The Greely relief relics attract a great deal of attention, including a great many articles illustrative of Greenland Eskimo life. In the government space are two anthropological exhibits. That of the Bureau of Ethnology contains the excellent models of Pueblos by the Mindeleff brothers, two Indian busts executed by Achille Collin, a fine group of potteries from Chiriqui and from the pueblos, and the superb cabinet of old pueblo pottery belonging to Mr. Thomas Keam, who also displays a large case of Moqui dance paraphernalia.

The Smithsonian exhibit contains a typical series of stone implements arranged by Dr. Charles Rau, and an educational series of modern Indian specimens covering the entire continent and including every category of savage culture.

The Mexican department cannot be too highly praised. In a store room at 45 Chartres street Mr. Abbadiano, a Mexican artist, has on exhibition a series of gelatine casts of celebrated Mexican antiquities for which he asks eight thousand dollars. The work in these far surpasses in delicacy that of M. Charnay in the Lorillard collection. It comes out also by examination that M. Charnay did not take the impression of the whole sacrificial stone but a group or two here and there and multiplied them to get the fifteen groups around the stone. Now in Abbadiano's cast of the whole stone it plainly appears that the second and fourth group to the left of the gutter contain women, and furthermore the ornaments on the persons of the captives are by no means all alike. M. Abbadiano's collection should find place in some great public institution, and it is to be hoped that he will succeed in placing it there.

The Mexican department proper contains about 700 cases, in every one of which something can be seen illustrative either of the old civilization of that country or of those interesting survivals and transitions which throw light upon the history of mankind. The native drinks from the yuccas and cactuses, leather

work textiles, figurines in costume, pottery, in fine, everything exhibited should find place in a permanent museum. The Mexican commission and government deserve the highest commendation for this interesting feature of the exposition. Even their musical exhibit in the celebrated band contained such instruments as the bandolon, salteria and timpanis, new to almost every visitor.

The Central American States of Guatemala, Honduras and Salvador also contains many objects of interest to the student of primitive culture, showing the continuance old Maya customs.

A great part of the Japanese exhibit is devoted to education in that country, and is designed to show not only the method of adopting new ideas, but the old customs are also set forth in quaint apparatus of older types. Quite a number of very primitive devices are also among the newer ones, lighting them up with excellent effect.

The Chinese department is devoted to showing the cotton industry in that conservative country. It is excellent. Here upon a series of wall screens is painted the whole operation from the planting to the wearing out. Around the space you see first a man ginning cotton with a little wooden thing that looks like a rude clothes wringer. Just beyond another is whipping it with a bowstring, and from point to point you are led by a series of dummies until the whole process is before you.

Of the vast arena for flying wheels and nice adjustments of machinery, the culmination of all those primitive arts which it is the delight of the anthropologist to trace, we have not space to say more than that its rythmic pulsations seem to beat time to the great song of human progress. Man has built no prouder monument to his conquest of nature than this busy, varied, noisy scene.

Dental Index.—It is quite probable that Professor Flower has hit upon a new and valuable index of race. In the Journal of the Anthropological Institute (XIV, 183) appears a paper of his on the size of the teeth as a character of race. As a test of the size of the teeth is taken "the length in a straight line of the crowns of the five teeth of the upper molar series *in situ*, between the anterior surface of the first premolar and the posterior surface of the third molar, which length is the *dental length* (*d*). For the divisor is taken the cranio-facial axis, or baso-nasal length (B N), the distance between the nasion (naso-frontal suture) and basion (middle of the anterior edge of foramen magnum). The index will therefore be $\frac{d \times 100}{B\ N}$ = *dental index.*

The result of applying this index will appear in the following tables:

	B N	d	Index.	Average index of both series.
Male gorilla, average of 3	124.0	63.0	50.8	54.1
Female gorilla, average of 3	108.7	63.3	57.3	
Male chimpanzee, average of 3	96.7	46.0	47.6	47.9
Female chimpanzee, average of 3	88.3	42.7	48.1	
Male orang, average of 4	109.2	58.0	53.1	55.2
Female orang, average of 2	90.0	51.5	57.2	
Male siamang, 1	79.0	33.0	41.7	

The races of men, as will be seen in the following table, may be divided into three classes by this index:

Microdont, below 42.

Mesodont, between 42–44.

Megadont, above 44.

Among the apes the first three species are megadont, while in the siamang the molar teeth are scarcely larger than in the higher races of men:

	Sex.	Observations	Average. B N	Average d	Average Index.	Aver'e Index both sexes.
Microdont Races.						
British	♂	20	100.0	41.0	41.0	41.3
"	♀	13	95.0	39.5	41.6	
Mixed European (not British)	♂	52	101.3	41.0	40.5	41.1
	♀	14	95.1	39.6	41.6	
Ancient Egyptians	♂	7	101.4	41.4	40.8	41.0
" "	♀	8	95.9	39.5	41.2	
Polynesians (mostly Sand'h Is.)	♂	22	105.3	42.2	40.1	
Low caste Cent. & S. India m'ly	♂	42	99.5	41.2	41.4	
Mesodont Races.						
Chinese	♂	12	98.8	42.1	42.6	
American Indians, all parts	♂	31	99.2	42.5	42.8	
Malays of Java, Sumatra, &c.	♂	70	99.7	43.2	43.3	
African Negroes, all parts	♂	44	103.3	44.5	43.2	
" " "	♀	26	97.9	43.6	44.6	
Megadont Races.						
Melanesians, various islands	♂	21	102.3	45.2	44.2	
Andamanese	♂	9	94.4	41.9	44.4	45.5
"	♀	8	88.8	41.2	46.5	
Australians	♂	22	102.5	45.9	44.8	45.5
"	♀	14	95.5	44.0	46.1	
Tasmanians	♂	9	100.0	47.5	47.5	48.
"	♀	4	95.5	46.5	48.7	

The Microdont races include all the so-called Caucasian or white races; the Mesodont the Mongolian or yellow races; the Megadont the black races, including the Australians. In the case of the Polynesians and African Negroes the index is reduced by

the greater length of the *basis cranii.* It may not be premature therefore to say that the species *homo sapiens* is divided into three sub-species as follows:

Microdont subspecies.
Mesodont subspecies.
Megadont subspecies.

We may then reserve the term *race* for those actual grand divisions of humanity, twelve or fifteen or more, as the case may be, resulting from the crossing of these sub-species.

MICROSCOPY.[1]

THE USES OF COLLODION.—In modern histological technique collodion has come to serve a variety of important purposes. Duval[2] was the first to call attention to its advantages as an imbedding mass. He found that it penetrated preparations easily and thoroughly; that it could be quickly brought to the proper degree of hardness in alcohol of 36° (80 %); that objects thus imbedded could be preserved in this alcohol for an indefinite length of time; that the imbedding mass preserved its transparency, so that the preparation could be easily examined; that the sections did not require to be freed from the mass, since they could be colored and mounted in glycerine, and the mass remain unaffected by the process.

As soon as Duval's discovery became known, Merkel and Schiefferdecker[3] began to experiment with collodion, and greatly improved and extended its use.

It was found desirable first of all to be able to vary the concentration of the collodion, an end very conveniently reached by Merkel through the use of a solid preparation, called *celloidin*, which he dissolved in absolute alcohol and ether in equal parts.

Duval mounted sections of objects imbedded in collodion in glycerine, and was unsuccessful in his experiments with balsam. Schiefferdecker has shown that by dehydrating the sections with 95 per cent alcohol, and clarifying in oil origanum or oil of bergamot, the sections could be mounted in balsam ("Microscopy," Aug., 1884, p. 843).

Some improvements of minor importance in the process of imbedding have been made by Thoma, Blochmann and others.

The importance of collodion in microtomy was much increased by the discovery that in combination with clove oil it could be used as a fixative for serial sections, and that the latter could be colored *after* they had been arranged and fixed on the slide. This invaluable method, discovered by Schällibaum,[4] presents all

[1] Edited by Dr. C. O. WHITMAN, Mus. Comparative Zoology, Cambridge, Mass.
[2] Journ. de l'anat. et de la physiol., XV, p. 185, 1879.
[3] Arch. f. Anat. u. Physiol., Anat. Abth., p. 199, 1882.
[4] Arch. f. mik. Anat., XXII, p. 689, 1883.

the advantages of the shellac method of Giesbrecht, and offers, at the same time, the best means of meeting the difficulties of staining objects in toto. The only other fixative thus far known which claims to accomplish similar results is that introduced by Mayer ("Microscopy," Feb., 1884).

Prof. Gage,[1] who began to experiment with collodion as a fixative prior to the publication of Schällibaum's method, has given some valuable directions respecting its preparation and application. Gage applies the collodion and clove oil separately, first coating a number of slides with collodion, which is poured on to one end of the slide and allowed to flow quickly over it and off into the bottle; and then, at the time of using, adding a wash of clove oil. In order to remove any cloudiness that may arise in the collodion film, a little clove oil is added to the balsam.

The use of collodion to prevent the crumbling of brittle sections originated with Norman N. Mason.[2] The same method was employed in Semper's laboratory by Timm,[3] Will,[4] Sarasin,[5] Sharp and others; and Mark has found it indispensable in sectioning the ova of Lepidosteus. Mason applied the collodion by means of a fine brush, taking up a small drop and placing it "in the center of the object so as to allow it to flow out on all sides to prevent the formation of air bubbles. After being allowed to harden a minute, the section may be cut and placed on the slide *with the film of collodion underneath.*"

Mark and others who have used collodion for the same purpose, simply paint the cut surface of the object with a thin film a few seconds before making each section.

Celloidin Injections.—In the formation of injection masses collodion plays still another important role, for the discovery of which we are indebted to Schiefferdecker.[6] It can be made to penetrate easily very fine blood-vessels, and its viscosity protects them against injury; its application is simple and easy, and in all these respects it is said to be superior to the masses hitherto employed for "corrosion preparations." It has a slight shrinkage, but not enough to form a serious drawback. It is prepared in different ways according to the color to be given to the injection.

A. Asphalt Celloidin Injection.—1. Pulverized asphalt placed in a well closed bottle of ether and allowed to remain twenty-four hours, during which the mixture must be several times shaken.

2. The brown-colored ether is turned off, and small pieces of celloidin dissolved in it until the solution flows like a thick oil.[7]

[1] The Medical Student, p. 14, November, 1883.
[2] AMERICAN NATURALIST, 1880, p. 825.
[3] Semper's Arbeiten, VI, p. 110, 1883.
[4] Semper's Arbeiten, VI, p. 7, 1883.
[5] Semper's Arbeiten, VI, 1883.
[6] l. c., p. 201.
[7] The pulverized asphalt can be used many times over for coloring the ether, as very little of it will dissolve in twenty-four hours.

B. Vesuvian Celloidin Injection.—1. Make a saturated solution of Vesuvian in absolute alcohol.

2. Dissolve in this pieces of celloidin until the desired consistency is reached. The brown injection thus obtained is less satisfactory than that formed from asphalt, as its color fades somewhat.

C. Opaque Celloidin Injections.—1. Dissolve celloidin in absolute alcohol and ether in equal parts.

2. Add vermilion or Prussian blue to color.

The coloring substance should be mixed with a small quantity of absolute alcohol and then reduced to great fineness by continued trituration in a mortar. To the thick paste-like mass thus obtained the solution of celloidin is next added. The amount of coloring substance should be as little as possible, as the mass will otherwise be too brittle. If a fine injection is required the mass should be filtered through flannel moistened with ether. The syringe employed must be entirely free from fatty substances, as these render the injection mass brittle. If the piston does not fit the syringe tube sufficiently closely, it may be wound with a little gauze. The cannula should be filled with ether before it is inserted and tied in place, and again filled just before it is joined to the syringe.

In using a mass dissolved in alcohol and ether it is well to add a little ether, which will spread over the surface and thus prevent the formation of a film. The injection should be made moderately quick, as the mass stiffens soon after contact with the tissues. After injection the syringe and cannula should be cleansed with ether.

The injected organ is placed in hydrochloric acid, diluted more or less according to the danger of shrinkage. It is left in the acid, which is occasionally renewed, until the tissues are sufficiently corroded to be easily washed away by a slow and steady stream of water, conducted through rubber tubing connected with a water-pipe. The preparation may then be left in water for some days or weeks in order to free it from remaining fragments of tissue by gradual maceration. The preparation when finished, may be preserved either in glycerine or a mixture of glycerine, alcohol and water in equal parts.

The asphalt-celloidin mass is the one most highly recommended by Schiefferdecker.—*C. O. Whitman.*

Notes on Section Cutting.—My only apology for the present communication is the hope that it may prove a saving of time to those who have encountered the difficulties of cutting eggs which are composed largely of yolk corpuscles liable to crumble in the ordinary paraffine method. The difficulty I have experienced lies not alone in the impossiblity of making sections—even from eggs very thoroughly permeated by the paraffine—which

will not crumble during the removal to the prepared slide, but also in the fact that sections successfully transferred to the slide are liable to have portions of the yolk granules loosened and floated over other portions of the sections during the removal of the paraffine. While by the ordinary methods of mounting (Geisbrecht, Schällibaum) those elements of the section which lie on its *under* side, and therefore come in immediate contact with the fixative, are safely held in place, it may happen that many from the *upper* surface are loosened and washed away, because the fixative does not penetrate the whole thickness of the section.

This obstacle may be entirely avoided by the proper use of collodion.

We are indebted to Mason,[1] so far as I am aware, for the first suggestion of the use of collodion in this connection. But the method employed by Mason has serious objections. A *drop* of collodion on the surface of a paraffine-imbedded preparation softens the object to such an extent that cutting is a very slow process, and thin sections are not easily attainable. The thickness of the collodion film, moreover, interferes more or less with accurate study of the mounted object, even if the sections are inverted when applied to the slide. The gradual drying of the surface of the film also causes the section to roll into a hollow cylinder with its collodion surface innermost, so that the inversion of the section becomes difficult if not altogether impossible. The consistency of the collodion to be used is stated by Mason, but this is of little value since even a short exposure to the atmosphere often repeated will quickly change the condition of the collodion in the bottle.

All these impediments—but for which the method, I believe, would have come into more general use—may be largely if not entirely obviated by using *a very small amount of a rather thin collodion.*

The criterion which serves me is: *the collodion must dry almost instantly* (within two or three seconds after being applied) *without leaving a trace of glossiness on the surface of the paraffine.*[2]

In this collodion process I use at present the following method:

The object imbedded in paraffine in the ordinary way is placed in a receiver of a Thoma's microtome and the paraffine cut away to within 1^{mm} to 2^{mm} of the object on four sides,

[1] N. N. Mason, Use of Colloidion in Cutting thin Sections of Soft Tissues. AMER. NAT., Vol. XIV, p. 825, Nov., 1880.

[2] Judging from the effects, I am inclined to think that by this method the collodion penetrates the preparation to a certain depth, fixing the parts in their natural relations without producing a superficial film. At any rate, if the sections are made sufficiently thin (e. g. 5μ) there is no curling, whereas with much thicker sections, the superficial portion of which alone contains in that case the collodion, there is often a tendency to roll. This I have attributed to the slight shrinkage in the upper or collodion-impregnated portion of the section.

leaving a rectangular surface of paraffine, two edges of which are parallel to the edge of the knife.

A slide prepared by being painted with *a thin coat* of Schällibaum's mixture of collodion and clove oil is placed at the left of the microtome.

At the right of the latter, handy to the right hand, is a small bottle half full of the thin collodion, into which dips the tip of a camel's hair brush; the quill of the brush is thrust through a hole in a thin flat cork which serves at once as a temporary cover to the bottle and a support to the brush, the latter being adjusted to any height of the collodion by simply shoving it up or down through the hole in the close-fitting cork. Near by is a small bottle of *ether* with which the collodion is thinned as soon as it begins to leave a shining surface on the paraffine.

The operator should sit *facing the light*, so that he may judge accurately of the condition of the surface of the paraffine, which reflects the light. Everything being in readiness the brush is lifted and wiped on the mouth of the bottle to *remove the most of the collodion*, and then the paraffine and object are *at once* painted by *quickly drawing the brush across the surface*, care being used that it is evenly applied and that the collodion is not carried on to the vertical faces of the block. The temporary moistening vanishes like a cloud from the surface of the paraffine, the brush is returned to the bottle at once; the knife is drawn and returned, leaving the section on the edge of the blade. The object in the block is then painted again, but before drawing the knife a second time the first section is removed with a scalpel and placed on the slide with its *upper face in contact with the fixative*. Then the knife is drawn again, and the other steps of the process repeated. Thus the collodion has time to thoroughly dry before the section is made. But if the precautions above given are observed, it will not be necessary to wait for the drying of the collodion and the section may therefore be cut at once, *i. e.*, within five seconds after painting. It is thus possible to cut as fast as one can paint the surface, and with some practice it becomes possible to cut *continuous ribbons* of sections which may be transferred at intervals. Practically I find it most convenient to cut enough to form one row or half a row of sections at a time and transfer at once to the slide, rather than to cut the whole object without interruption as is done in the ordinary method.

The following precautions may prove serviceable: Especial care should be exercised to prevent the painting of the vertical face nearest the operator, since the section is then liable to cling along its whole edge to this vertical film and be carried *under* the knife blade. If by chance this should occur, the section should be removed from the block *before the knife is shoved back*, as it is liable to be caught and lacerated between the face of the block and the under surface of the returning blade. The possibility of

the section being thrown under the knife blade, may, however, be obviated either by carefully trimming the vertical face in case it is accidentally painted (to allow for which the *hither margin* of the paraffine may be left broader than the other three), or by drawing the knife *slowly*, so that the first indication of a failure to cut through the vertical film may be recognized and the section held in place on the blade by a slight pressure with a soft brush, whereupon the knife will cut through the film and leave the section free.

If by chance the paraffine block has been painted with too much collodion or with collodion which is too concentrated, thus leaving a shiny surface, the film should be at once broken by pressing it gently two or three times in quick succession with the end of a rather stiff, blunt, *dry* brush. This enables the collodion to dry quickly and thus prevents the softening of the paraffine.

If the sections have a tendency to curl they may be flattened out on the slide by means of a brush, for a section thus impregnated with collodion may be handled during the first few seconds after contact with the Schällibaum mixture with much greater impunity than one not so treated. If the collodion has been too much thinned with ether, the fact will become apparent from the softening of the paraffine, and may be remedied by waiting for the evaporation of the ether, or by adding thicker collodion.

This process can be in no way considered as a substitute for the ordinary method of cutting objects since it requires more time and closer attention to details, but for those cases where there is a liability to crumbling, or where sections of sufficient thinness cannot be procured free from folds, it will doubtless be found very serviceable.—*E. L. Mark, Mus. Comp. Zoöl., Cambridge, Jan., 1885.*

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SCIENTIFIC NEWS.

— At a late meeting of the Liverpool Microscopical Society, Mr. A. Norman Tate read a paper, which is reported in the *English Mechanic*, on the microscopical examination of potable water. After alluding to the impossibility of always determining by chemical means alone whether a water is or is not fit for dietetic purposes, he proceeded to speak of the importance of microscopical investigation in relation to water-supply, pointing out that it afforded better opportunity of determining the character of organic impurities, and that it might frequently assist in ascertaining the character of the mineral constituents. He considered the arbitrary standards of purity as regards organic constituents, set up by some water analysts as being unsafe to use, without knowing the exact nature of such matters. And in deciding this the microscope could help. He then proceeded to speak of in-

vestigations concerning the minute animals and plants in waters contaminated with sewage, &c., and then described different modes of collecting and examining waters microscopically, and urged the importance of further investigation, so as to ascertain how far the organized matters present in water are capable of developing disease, and how such organisms may be destroyed by various means, describing several modes which might be adopted in carrying out such inquiries. In conclusion he mentioned impurities found in natural ice, and also two methods of examination of rain and air.

— In the death of Th. C. von Siebold, at the age of 80, Germany has lost one of her foremost biologists, while as a comparative anatomist he has held a prominent position for over fifty years. He will be remembered for his Comparative Anatomy of the Invertebrates, which was translated into English by Burnett in 1854, and is still nearly indispensable; for his fruitful labors on parthenogenesis in bees, saw-flies, moths, the Branchipodidæ and Apodidæ, his work on the Salmonidæ and their hybrids, and on intestinal worms, which made him second to none of the biologists of Europe, not even excepting Darwin. He was, with Professor Kölliker, the founder of Siebold and Kölliker's *Zeitschrift für wissenschaftliche Zoologie*, a journal which has done more than any other to elevate the tone and spirit of biological research. He was a most unaffected man, most cordial in his reception of young men, and he died at Munich full of honors.

— The Official Gazette of India reports that in 1883 the number of persons killed by wild beasts and poisonous snakes were 22,905, against 22,125 in 1882. 20,057 deaths were due to the bites of poisonous animals; 985 persons were devoured by tigers, 287 by wolves, and 217 by leopards. The loss of cattle amounted to 47,478 animals, an increase of 771 over the preceding year. While most of the deaths of human beings was due to the bite of snakes, only 1644 cattle were thus poisoned. More than three-quarters of the deaths took place in Bengal and in the provinces of the north-west. 19,890 dangerous animals were killed during the year.

— In a recent memoir by F. A. Forel on the deep fauna of Swiss lakes, he corrects the facts and theories which he had previously advanced on the origin of the blind Gammarus and Asellus of the deep parts of the lakes. Formerly he attributed them to direct emigration from a littoral fauna, which, penetrating into a region devoid of light, had there lost the visual organ and pigment. New researches have now led him to conclude that these blind animals have descended from cave-inhabiting forms which had already become differentiated in the dark subterranean waters.

— The April number of the Journal of the Royal Microscopical Society contains Rev. Mr. Dallinger's notable address on the life-history of the monads, illustrated by three excellent plates. He concludes that the vital processes in these lowest organisms are as "orderly, rigid and immutable as in the most complex organisms," though as in higher animals allowing free scope to the action of natural selection.

— The *Annals and Magazine of Natural History* for January last publishes an article from the *Illustrated Melbourne Post* for Sept. 24, 1864, in which it is stated that about ten months previous an Ornithorhynchus laid "two eggs which were white, soft and without shell."

— ERRATA.—In Vol. XVIII, p. 1259, and Vol. XIX, p. 277, it is stated that two trilobites have been discovered in the Cretaceous rocks of Australia. This is an unfortunate error which our readers will please correct.

P. 293, lines 10 from top and 2 from bottom, for emarginate *read* marginate.

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PROCEEDINGS OF SCIENTIFIC SOCIETIES.

NATIONAL ACADEMY OF SCIENCES.—This body met in Washington, D. C., April 21st. The following papers were read:

1. Methods of measuring the cubic capacity of Crania, by J. S. Billings and Dr. Matthews, U.S.A. 2. On winged insects from a palæontological point of view, by S. H. Scudder of Cambridge, Mass. 3. On the Syncarida, a hitherto undescribed group of extinct malacostracous Crustacea, by A. S. Packard of Providence, R. I. 4. On the Gampsonychidæ, an undescribed family of fossil schizopod Crustacea, by A. S. Packard of Providence, R. I. 5. On the Anthracaridæ, a family of Carboniferous macrurous decapod Crustacea, allied to the Eryonidæ, by A. S. Packard of Providence, R. I. 6. On the coral reefs of the Sandwich islands, by Alexander Agassiz. 7. On the origin of the fauna and flora of the Sandwich islands, by Alexander Agassiz. 8. On the classification of natural silicates, by T. Sterry Hunt of Montreal, Canada. 9. On the cause of the progressive movement of areas of low pressure, by Elias Loomis of Yale College. 10. On the ratio of the meter to the yard, by C. B. Comstock. 11. An account of certain stars observed by Flamsteed, supposed to have disappeared, by C. H. F. Peters, Hamilton College, N. Y. 12. On the submarine geology of the approaches to New York, by J. E. Hilgard and A. Lindenkohl. 13. A biographical notice of the late Dr. J. J. Woodward, U.S.A., was read at this meeting by J. S. Billings. 14. The orders of fishes, by Theodore Gill. 15. On the organization of the tribe, by J. W. Powell. 16. On certain lunarine qualities due to the action of Jupiter, and discovered by E. Nelson, by G. W. Hill. 17. On the Pretertiary Vertebrata of Brazil, by E. D. Cope. 18. On the phylogeny of the placental Mammalia, by E. D. Cope. 19. On some recent observations upon the rotation and surface markings of Jupiter, by C. A. Young. 20. On the value of the Ohm, by H. A. Rowland. 21. On the vanadium minerals: Vanadinite, endlichite and descloiz-

ite, and on iodyrite, from the Sierra Grande mine, Lake valley, New Mexico, by F. A. Genth and Gerhard von Rath. 22. On the total solar eclipse of August 28th, 1886, by A. N. Skinner (by invitation). 23. On the evolution and homologies of the flukes of Cetaceans and Sirenians, by Theodore Gill and John A. Ryder. 24. Biographical notice of Gen. A. A. Humphreys, U.S.A, by H. L. Abbot. 25. Chemical action in a magnetic field, by Ira Remsen. 26. On the measurement of hearing power, by A. Graham Bell. 27. On the possibility of obtaining echoes from ships and icebergs in a fog, by A. Graham Bell and Mr. F. Della Torre. 28. Biographical notice of William Stimpson, by Theodore Gill.

The following gentlemen were elected members of the council: Professors Gibbs, Baird and Young, Gen. Meigs, and Messrs. Hilgard and Scudder. The following gentlemen were elected members: Henry Mitchell, Wm. A. Rogers, Edw. S. Holden, F. W. Putnam, Arnold Hague.

American Geographical Society, April 11.—Hon. John W. Hoyt delivered a lecture entitled Wyoming: its resources and wonders (illustrated by stereopticon views).

Biological Society of Washington, April 4.—The following communications were made: Professor C. A. White, On vegetable cells; Mr. Frank H. Knowlton, remarks on some Alaskan willows and birches; Dr. Frank Baker, Muscular equalization.

April 18.—Dr. D. E. Salmon and Dr. Theobold Smith, Koch's method of isolating and cultivating Bacteria, as used in the laboratory of the Bureau of Animal Industry; Mr. A. B. Johnson, The shipworm and the sheeps-head; Mr. G. Brown Goode, Remarks on the velocity of animal motion; Mr. Romyn Hitchcock, Exhibition of a preparation of the "comma Bacillus" of cholera.

May 2.—Dr. Thomas Taylor, The white rust of cabbages, *Cystopus candidus* (with illustrations); Mr. H. W. Henshaw, hybrid quail; Mr. W. H. Dall, Notes on a journey in Florida.

New York Academy of Sciences, April 6.—George F. Kunz made some general remarks on the mining and cutting of gems (illustrated with a series of lantern slides).

April 13.—The language of the ancient Egyptians and its monumental records (illustrated with lanterns), by Dr. Charles E. Moldehnke.

April 20.—Professor D. Cady Eaton lectured on the Canterbury cathedral.

April 27.—Cotton in Brazil: its history, methods of cultivation and the insects affecting it, by Mr. John C. Branner; Mr. G. F. Kunz presented some brief notes on a remarkable meteorite.

May 4.—Notes on building stones: No. 2, Limestones, by Dr. Arthur H. Elliott.

Boston Society of Natural History, April 1.—Professor G. F. Wright gave an account of his latest investigations upon the

terminal moraine from the Atlantic to the Mississippi, describing also the buried forests in Southern Ohio, and the terraces of the Monongahela and Allegheny rivers, supposed to be connected with the ancient ice dam at Cincinnati (numerous original stereopticon views were shown in illustration); Mr. S. H. Scudder spoke of the geological history of insects.

April 15.—Mr. Percival Lowell read a paper on the mythology of the Koreans (stereopticon views were shown in illustration).

May 6.—Mr. George H. Barton gave an account of the ancient land-system of the Hawaiians.

Appalachian Mountain Club, May 13.—A paper by Mr. F. H. Chapin, on An ascent of the Rothhorn was presented; Mr. S. H. Scudder gave an account of a winter excursion to Tuckerman's ravine.

Philadelphia Academy of Natural Sciences, March 3.—Mr. Meehan called attention to a specimen of *Cypripedium insigne* which had developed two flowers instead of the usual one, and was thus on the way toward a spicate inflorescence. The upper three-lobed petal had also become one-lobed, and the labellum in the upper flower was only twice instead of three times, the length of the column. Mr. Meehan considered such changes as nature's efforts to establish new forms.

Dr. Leidy had recently received from Florida remains of a species of Rhinoceros, including the crown of the last upper molar. The latter indicated a species not before described. which he proposed to name *Rhinocerus proterus*. The speaker expressed his belief that Dinoceras Marsh, was equivalent with Uintatherium Leidy.

Mr. A. H. Smith gave an account of a boring on Black's island, below Fort Mifflin, Delaware river. The boring passed through the following deposits. Alluvial mud seventy-five feet; dark gravel, six feet; white tenacious clay, two feet; beach-sand forty-seven feet; gravel, two feet, and then again beach-sand.

Professor Heilprin thought that, in the light of this boring, the beach-sand might be cretaceous. The same speaker then read a continuation of his paper on disputed geological and palæontological points.

March 10.—Dr. Leidy exhibited the upper molar tooth of a Hippotherium, belonging to an animal of about half the size of the horse. The example was from Florida, and in the same collection with it were some fossil crocodile bones, and the end of the phalanx of an extinct llama or camel, probably indicating new species.

Professor Heilprin stated that he had made a careful microscopic examination of the sand from the boring below Fort Mifflin, but had found no traces of Foraminifera. The roundness of the grains might indicate sea-sand.

AMERICAN PHILOSOPHICAL SOCIETY, Sept. 19, 1884.—The Secretary presented a series of thermometrical observations taken at Quito, Ecuador, between Sept. 17, 1858, and June 18, 1859, by Mr. C. B. Brockway.

Oct. 3.—Mr. Wall exhibited a full-size canvas tracing of a large group of Indian pictures cut on the top and sides of a half-buried block of sandstone, lying near the bluff of the Monongahela valley, in Fayette county, Pa., 290 feet above the river. Photographs of this and also of carvings on the shore of the same river, near Geneva, and of a carved rock on the Evansville turnpike, West Virginia, were also exhibited.

Mr. Lesley read a paper upon the possible origin of the double crown of Egypt; and also exhibited a square pipe of limonite, deposited against the walls of a vertical drain at the Eagle shaft, near Pottsville.

Dr. Syle presented a Chinese translation of Herschell's Outlines of Astronomy, published at Shanghai, Dec., 1859.

Oct. 17.—Dr. D. G. Brinton presented a communication upon the language and ethnographic position of the Xinka (Shinka) Indians, with two vocabularies of three dialects. Mr. Ashburner read some notes upon the origin and dimensions of the Natural Bridge of Virginia. A communication upon the doubtful character of Professor Lewis's alleged continuous range of trap through Southern Pennsylvania, was made by Dr. Frazer.

Nov. 7.—Dr. Syle made a verbal communication on the structure of the Chinese language and exhibited copies of the Shanghai Chinese *Illustrated News.* Professor Cope presented a paper by Miss Helen C. D. Abbott, entitled An analysis of the bark of the *Fuquiera splendens.* Professor Cope proposed to communicate A revision of the Reptilia and Batrachia of Mexico and Central America.

Nov. 21.—J. J. Stevenson presented Notes on the geological structures of Tazewell, Russell, Wise, Smith and Washington counties, Virginia; and Professor Daniel Kirkwood read a communication upon The limits of stability of nebulous planets.

Dec. 5.—Professor J. J. Stevenson communicated Notes on metamorphism; Dr. P. Frazer exhibited and explained his invention of an improvement on the pocket compass; and Mr. Ashburner exhibited a new map of the anthracite region.

Dec. 19.—Professor Cope read by title Twelfth contribution to the herpetology of Tropical America.

Mr. Ashburner communicated some notes on the recent publications of the Second geological survey of Pennsylvania.

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